

DESIGN OF AN INDUSTRIAL TOWN  
BLACK LAKE, MICHIGAN

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1915



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Design of an industrial town  
on Black Lake, Michigan

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DESIGN OF AN INDUSTRIAL TOWN

ON BLACK LAKE, MICHIGAN

# A THESIS

PRESENTED BY

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TO THE

PRESIDENT AND FACULTY

OF

ARMOUR INSTITUTE OF TECHNOLOGY

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DATE

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## REFERENCES

Blanchard and Drowne, "Highway Engineering"

Frank Koester, "City Planning"

Ogden, "Sewer Systems"

Engineering News, Volume 70, "The Industrial City of  
Torrance, California"

Engineering News, Volume 71, "Office Methods in  
Planning a New Town"



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## PART I. INTRODUCTION

It is our aim in this Thesis to plan the town site for an industrial center. The prime factor which has determined the exact location is the nature of the industries to be situated in the town. We have arbitrarily decided that the dominant industry shall be the manufacture of steel, and we have grouped about the steel mills such allied industries as would naturally seek a favorable location in proximity to the mills.

The first step, therefore, is the choice of site. From various considerations we have fixed upon the territory lying to the North of Black Lake, Michigan, in the township of Holland. We then investigated the locality itself, and determined roughly upon the features of the town.

We have divided the town into three sections: the industrial area, the residential area, and the park area. As it had not been our intention to go into the intimate details of industrial location, we have given over to the industries a suitable area



but have made no attempt at further subdivision. Most of our efforts have been spent upon the residence section where we have covered all phases of the design. That part of the site which, because of its topography, was unsuitable for a regular street scheme has been treated as a park area. In making the primary divisions we kept in view the possible future expansion of the community.

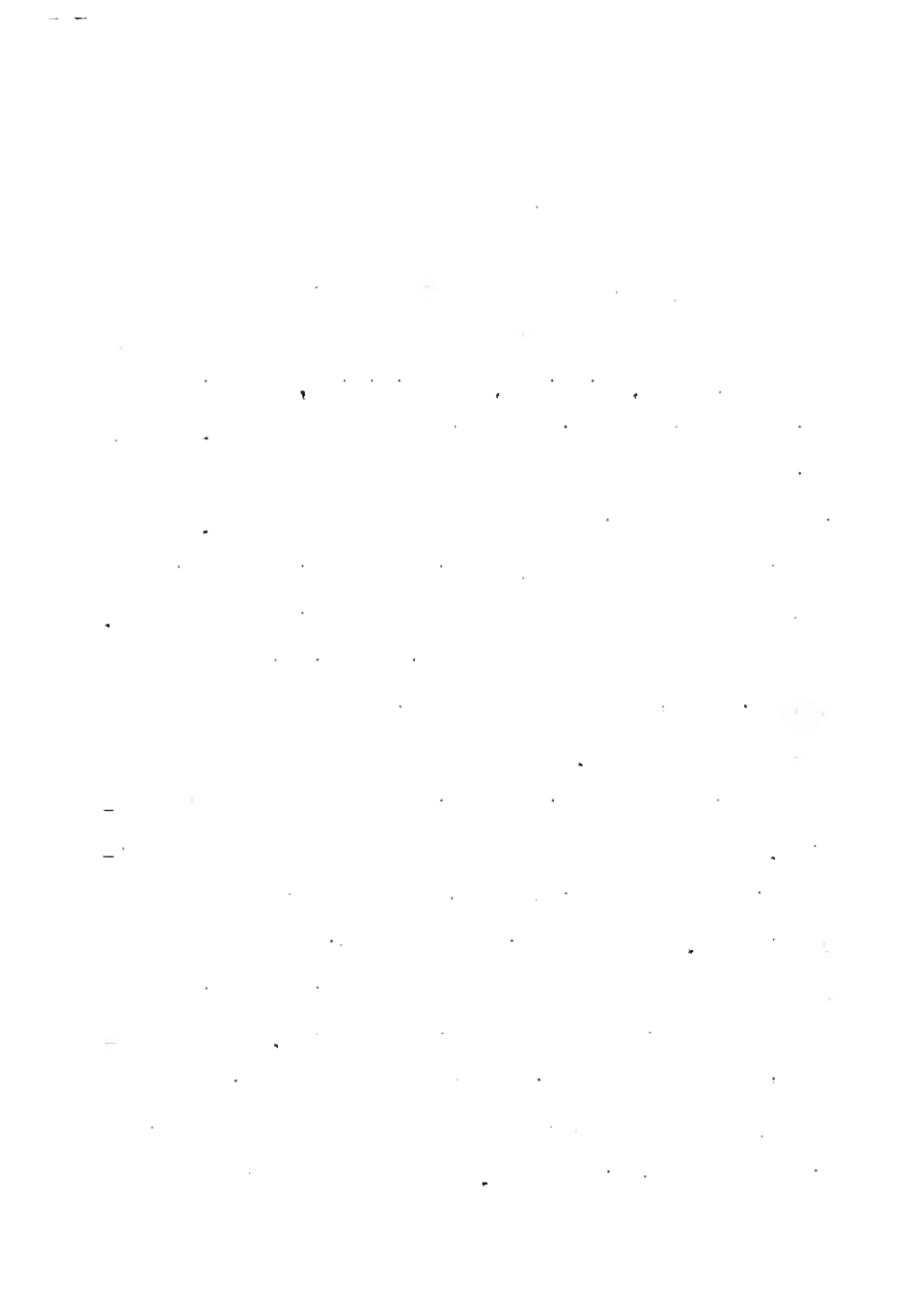
The details of the design of the residential section naturally fall under three headings: subdivision, determination of grades, and location of public utilities. Under the first we have covered the problems of street layout, division into lots, and the reservation of sites for public and semi-public institutions and plants. In determining grades we have considered the adaptation to the configuration of the ground and the requirements of traffic. We have considered the utility systems for sewage disposal, storm water removal, water supply, fire protection, gas supply, commercial electric light and power, street lighting, and telephone, and have assigned them definite positions in alleys and parkings.



## PART II. METHOD

The greater part of the information concerning the town site was obtained from the Great Lakes Survey Map of Holland, Michigan, and vicinity, of which plate 1 is a tracing showing all important features. From this map an enlargement to the scale of 500 feet to the inch was made which is represented by plate 2. On tracing paper placed over this map various possible street layouts were sketched and one finally adopted.

The scheme adopted was laid out in ink upon a blue line print of plate 2 showing center lines of streets and alleys. The ground profile along the center line was readily obtained by the following device. A sheet of tracing paper was ruled with parallel lines one half inch apart representing ten feet vertically. The zero line was superimposed upon the center line of the street and perpendicular lines drawn from points of street intersection. The intersections of contour lines with the center line of street were then projected upon the proper elevation line on the tracing paper. Through the points thus



located the ground line profile was drawn and inked. Certain points of control were next established and the grades of the main streets determined. Using these as a basis, several possible schemes of grading were sketched with pencil upon the tracing paper. As an aid to this work two lines intersecting at an angle representing a grade of three percent were inked on separate paper. When this was placed beneath the tracing paper with one line in a horizontal direction, and the vertex under a point of established grade, the other line indicated the maximum gradient. This was done by having one man establish grades on North and South streets while another man checked on East and West streets. When several designs had been so sketched, the most feasible one was selected and inked. From it tracings were made as shown in figures 1 to 11. In order to save drafting work on tracings the scheme was adopted of making a tracing to suit one plate, having a brown print negative made from it, and then changing the tracing by erasure and addition to suit another plate. Where one series of plates, 8 to 12, differed only in special features and all required the same blue line back ground, a single negative was used with various appropriate title negatives which



were inserted in a space cut out from the negative plate. This scheme was carried still farther in the preparation of plate 8. A brown line print was made from the standard negative and on this the required figures were inked, giving a tracing from which the plate could be produced in blue line.

Plate 5, which was desired to show the relation between the topography of plate 2 and the street grades of plate 6, was printed from a negative made by simultaneously exposing the tracings of plates 2 and 6.



## PART III. DESIGN

The requirements for a locality suitable for steel mills are good land and water transportation and accessibility to ore and coal fields. Limiting ourselves to the Lake Michigan area, we have investigated the feasible sites not already occupied and believe that the best is that portion of the northern shore of Black Lake immediately adjacent to Lake Michigan as shown in plate 1.

Black Lake affords safe harbor for boats of all sizes. The channel is of adequate depth for ore boats. It at present has a maximum depth of eighteen feet and could easily be dredged to any depth required. This would permit ore and freight vessels to dock at a minimum distance from the plants.

A branch line of the Pere Marquette at present has its terminus within the town site and connects through Holland with all the railway systems of the State. The Grand Rapids Holland and Chicago Electric Railway and Interurban line parallels the southern shore of the lake and can be brought into the town



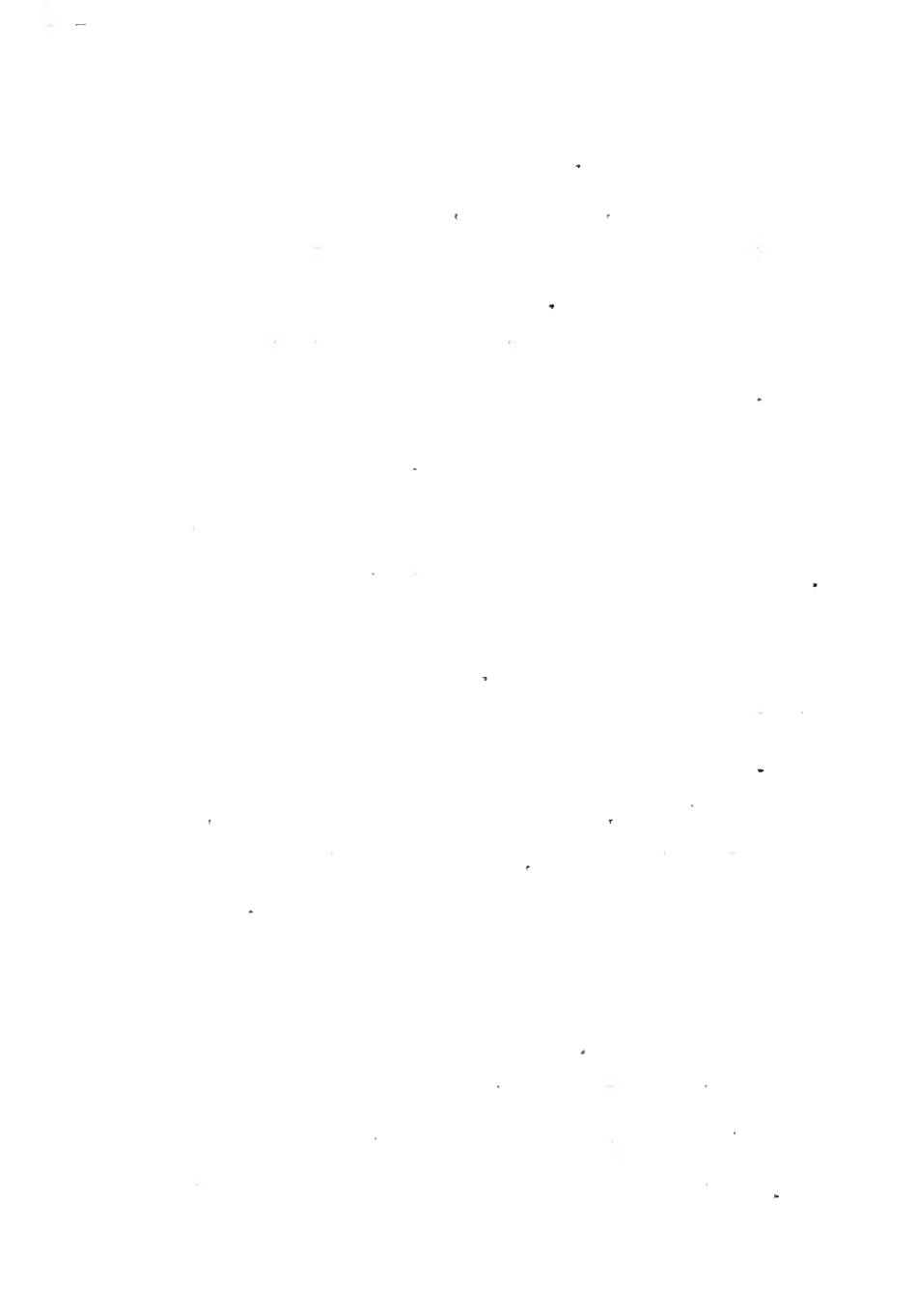
across the channel.

Iron ore is, therefore, available in unlimited quantities from the Lake Superior region by cheap water transportation. Coal may be obtained from the coal fields of either Michigan or Illinois by rail or water.

### Topography.

The topography of the town site is shown in plate 2. Along the shores of Lake Michigan is a range of sand hills varying in height from 100 to 180 feet covered with small timber. The southern portion of this is at present a summer resort known as Ottawa Beach. West of these hills in a direction of what is known as Big Bay, a shallow arm of Black Lake, the ground is fairly level, never exceeding fifty feet and being mostly below the twenty foot contour. The waters of Black Lake for about 100 feet off shore are very shallow and then shelve off abruptly to depths greater than eighteen feet.

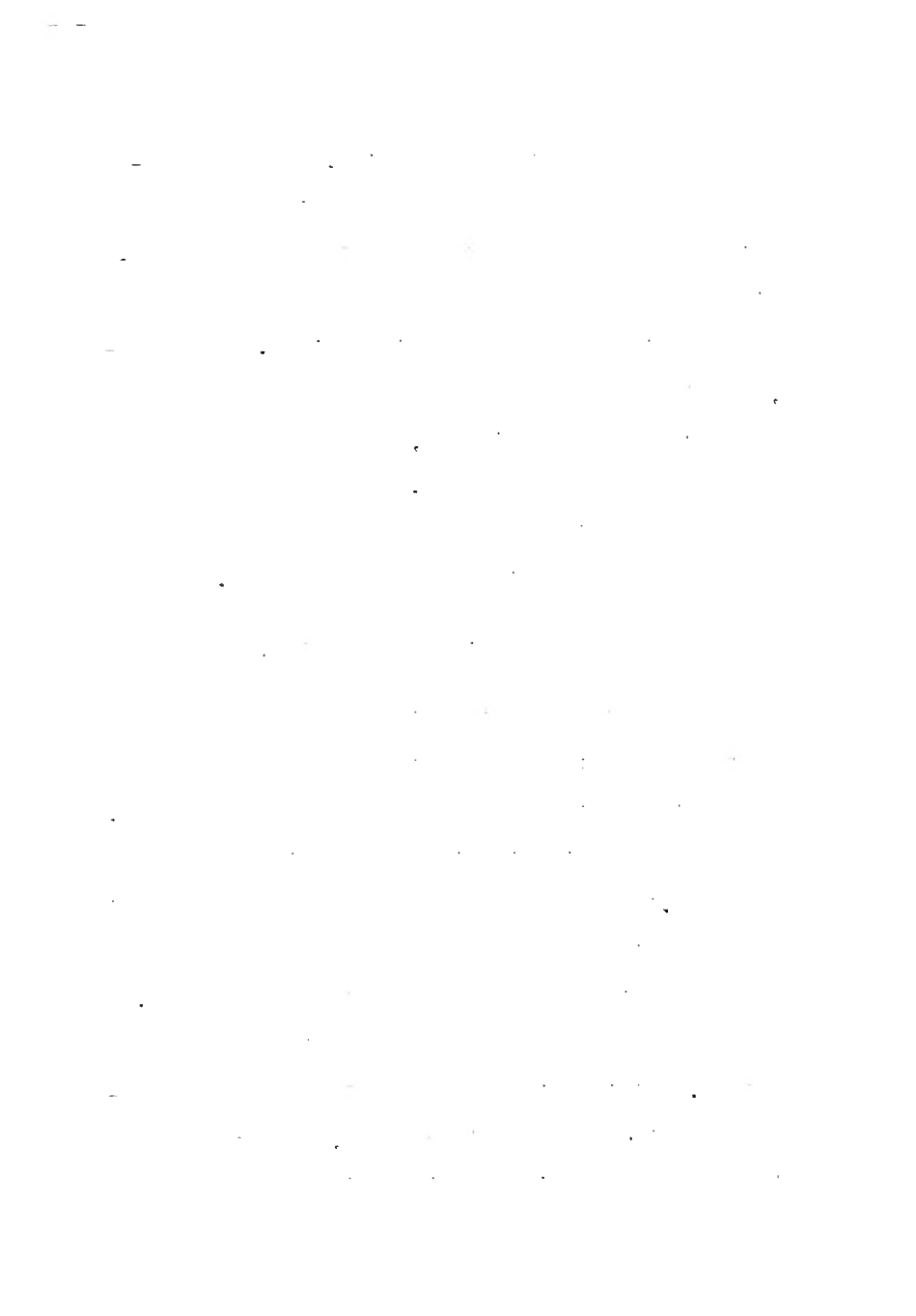
The industrial section of the town must be located in proximity to the wharves at which large vessels may dock. This at once places the industrial section in



the eastern portion of the town site. The land between the industrial section and the hills is suited to residence purposes and is subdivided accordingly. The hills are so rough that a rectangular system of streets covering them would be impossible. Nevertheless, portions of them would make good dwelling sites for the more wealthy residents, and an irregular street system has been adopted. Other portions of this same hill region are reserved for parks and the whole area will be considered a park section.

#### Size of Town and Division of Site.

The industrial district will be separated from the residence section by the right of way of the Armour Terminal Railroad located as shown on Plate 3. The land East of this line is low and will require some filling. In order to permit large boats to dock it is necessary either to dredge extensively up to the present shore line or to build out into deep water. The latter plan has been adopted as being the more economical. Piling will be driven into the lake bottom along a line as shown in plate 3, and the enclosed portion of the lake will be filled in by use of the



spoil from the grading of the residence section, and by hydraulic dredging beyond the foot of the piling thus deepening the water at the same time. Big Bay will practically disappear and it will be necessary to rectify the course of Big Creek as shown in plate 3.

The exact dimensions of the various industries is not fixed and this makes it impossible to determine, to any extent, the routs of traffic in this section. The three East and West thoroughfares, Trinkaus, Duffy, and Dean streets, are provided, and one transverse parallelling the Railroad, Altman Avenue. Other streets must be located to suit the particular industries served. The area of this district South of Trinkaus Street is approximately two hundred acres.

Similar industrial sections furnish employment for 2000 to 2500 men according to the best information available. We have assumed 2200 such and 500 more employed in other parts of the town. This gives us a total of 2700 people engaged in remunerative occupations. The United States Census Report, 1910, gives us for industries of the class located in this town the following figures as to the kind of employees:-

5 percent proprietors and officials.



12 percent clercks.

83 percent wage earners.

The total population of the town from comparison with the census figures for similar towns has been taken at 10,000. We have considered that 2000 of the employees belong to the class of cheap foreign labor and that these with their families furnish 75% of the population, the 700 better class workers with their families making up the other 25%. This means that we must plan the residence district for 2500 belonging to the better class families and 7500 of the proletariat. These figures are very rough, but it is necessary to have some basis for planning the residence section and they furnish the best one to be had.

A standard length of block of 660 feet was adopted throughout the residence section. The main residence streets are taken North and South and are located 330 feet apart. The width of all streets is 60 feet, and alleys 20 feet. The depth of a residence lot will, therefore, be  $(330 - (60 \div 2)) \div 2$  or 125 feet. The lots in the poorer section are thirty feet wide and those in the better section fifty feet wide.

At six persons per lot for the poorer class sec



tion, the number of lots required would be  $7500 \div 6$  or 1250. At forty lots per block this amounts to  $31\frac{1}{4}$  blocks.

At four persons per lot for the better class section, the number of lots required is  $2500 \div 4$  or 625. At 24 lots per block this amounts to 26 blocks.

The Eastern section of the residence district will be given over to the proletariat and the Western section to the better class.

As stated above, the general street plan consists of blocks 660 feet long, center to center of streets, North and South, and 330 feet long, center to center of streets, East and West. Four exceptions to this must be noted. In the Eastern section Railroad Avenue parallelling the right of way of the Armour Terminal Railway cuts irregular blocks because of its northeasterly direction. In the southwestern portion the presence of a steep hill necessitates an irregular layout for Raymond and Jucker Streets. Similarly, farther North, Kiene Street is run Northwest to avoid a hill. The blocks along Phillips Boulevard are also irregular.

All of these features appear on plate 3.



### Provision for Traffic.

The next feature of the layout is the provision for traffic. Traffic may be divided into three classes, i.e., pedestrian, vehicular, and rail. The two latter classes will be confined, to a large extent, to the industrial district. The Armour Terminal Railroad Company will handle all rail operations using electric traction locomotives and thus doing away with steam locomotive nuisance and expense. The trains of the Pere Marquette will be brought in over the Terminal Railroad to the Union Station and the Interurban trains from the South will cross the channel by the lift bridge, and run over the Terminal Railroad right of way to the Union Station. A single track street railway will branch off from the Terminal railway at Penn Avenue, proceed North to Kiene Street, and thence West to its terminus at Raymond Parkway. This will be used by the Interurban and town cars. Freight side tracks from the Terminal Railroad will lead through the industrial district as conditions demand. The railway from Dean Street North will be elevated, and intercourse between the residence and industrial districts will be confined to the subways at Duffy and



Trinkauss Streets. There will be no cause for heavy vehicular traffic West of Penn Avenue, and East of that thoroughfare it will probably be confined to Railroad and Sherman Avenues, Phillips and Sproesser Streets, and the streets of the industrial district.

The size of the town permits residents of any part walking to work, and the same thoroughfares that are used for vehicular traffic will serve this purpose.

#### Location of Public Utilities.

In planning a town of this kind it is necessary to reserve space for various public and semi-public utilities and plants. In some of these the matter of location is purely arbitrary while various conditions govern in other cases. The municipal buildings (City Hall and Police Station) and the Post Office will be located on three sides of City Hall Park, the fourth being occupied by the Union Station. Another park is reserved at the intersection of Phillips and Armstrong Boulevards. The Public Library is situated on Armstrong Boulevard and Trinkaus Street near the High School. Provision is made for three grammar schools in different sections of the town and off the main thoroughfares. The High School is located as near the center as possible. Four fire companies are located within easy reach of all parts of the town.



thoroughfares. The High School is located as near the center as possible. Two fire companies are located within easy reach of any part of the town. A hospital is placed in the park on high ground within a few minutes ride of any part of the industrial district. The municipal plants for sewage and garbage disposal and the street cleaning department are located to the East of the town proper on Big Creek and the railway. Electric light and power and gas plants are arbitrarily situated on Dean Street. The pumping station is located at the end of Kiene Street whence the water is pumped to a reservoir on the top of an adjacent hill. This location of the pumping station permits of coal being transported to it over the street railways. The Telephone Exchange is located at Phillips Street and Penn Avenue.

All of these features appear on plate 4.

#### Street Grades.

In establishing the grades on residence streets the maximum was placed at three per cent. But this was exceeded in one or two exceptional instances on unimportant streets for reasons of economy. The orig-



inal elevations of the ground and the established grades are shown on figures 1 to 11 inclusive. The established elevations showing relation to topography are shown on plate 5.

In designing roadways the standard width for streets is taken at thirty feet. This is increased to forty feet on Penn Avenue and Kiene Avenue where there is a car track. The Boulevards will have two thirty foot roadways with parking in the center. The space between the curb and property line is reserved for side-walk and parking. The standard width of side-walk will be six feet except on the streets along which the car line runs where it will be ten feet.

Four kinds of surfacing are used. Heavy traffic thoroughfares are paved with brick. Boulevards and some of the best residential streets are of asphalt. Other residential streets are paved with creosoted block, while the streets in the poorer district are macadam. The distribution of these types of surfaces is shown on plate 6.

#### Location of Public Utility Pipe Systems.

The section beneath the parking will be reserved



for public utilities. wherever it is necessary to run these along a street or avenue. No public utility will be permitted under the roadway except where it crosses from one side to the other where a tunnel large enough to permit repairs to be made shall be provided.

It is the aim, however, to keep public utilities off the streets and locate them in the alleys. There are five such utilities, - sewer, water, gas, electric power, and telephone; and each of these is assigned a definite location beneath the alley. A typical alley section is shown in figure 12; a typical street section in figure 13.

Where it is necessary to locate a trunk distribution line for one of the utilities beneath a parking space, only one such trunk line is so located. Certain streets are assigned to each utility for the location of trunk lines. Similarly, no two trunk lines are run down the same alley. The reason for this is not so much that there is not room enough for more than one, but that in case one line must be relaid or repaired a second line in the same section would almost invariably be disturbed, and it is better that



such disturbed line be an auxiliary or feeder rather than trunk line.

Plate 7 shows the assigned position of all trunk lines.

#### Sanitary Sewer:-

We have adopted three standard types of sewers. The smallest size, six inch, is used for feeder lines of not over 3000 feet length which do not have more than two branches. This is laid on a gradient of one-half of one per cent. Trunk lines are, in general, twelve inch pipe laid on a grade of fifteen-hundredths per cent. But the trunk line along Altman Avenue, because of restrictions of grade, is eighteen inches laid on one-tenth per cent grading.

Manholes are located at all intersections of sewer lines within the parking space. Drop manholes are used wherever the surface grade warrents. From considerations of cost the following rules for their use have been adopted:- one in the middle of the block for a rise of  $7\frac{1}{2}$  feet in 660; one at each third point for a rise of  $9\frac{1}{2}$  feet in 660; one at each quarter point for a rise of  $11\frac{1}{2}$  feet or greater in 660.



Plate 8 shows the location of all sewer lines and manholes.

#### Storm Water Removal:-

The soil throughout the town site is sand, and water drains off through it so readily that it is not necessary to design a system for the removal of storm water. Drains will be provided through the street curb into the soil beneath and these will suffice for all but exceptional storms. When such occur, a flooding of the streets for a brief period will not cause sufficient damage to warrant the expense of a system.

#### Water Supply:-

Water for household purposes will be obtained through a crib located in Lake Michigan opposite Phillips Boulevard. A tunnel will connect this with the Kiene Street Pumping Station. A reservoir located on Reservoir Hill at an elevation of 120 feet gives an ample head of water throughout the town. All the water used will not be pumped through this reservoir, but the latter will be so connected that it will maintain the head. Mains will lead directly from the pumping station to various parts of the town. Feeder



mains will branch off from these and run down all the alleys. Cut-offs to such mains are located in the parking or alley through which the trunk runs. House connections for four adjacent lots will be made in one box in the alley, in which box the meters and cut-offs will also be located.

The water system is shown in plate 9.

#### Fire Protection:-

A fire hydrant will be located at each alley on Eastband West streets. This will be of standard type with two spouts. With the head of water maintained by means of the reservoir a stream from one of these hydrants would be sufficiently powerful for use in fighting most fires without the aid of an engine.

All mains are designed for a head of 150 feet, but the details of sizes, connections, etc. have not been entered into.

#### Gas:-

Gas for household and commercial purposes will be produced in the industrial district and piped throughout the town as shown on plate 10.

#### Electric Power and Street Lighting:-



Electric Power will be produced in the industrial district and transmitted A.C. throughout the city at 600 volts. Connections to four adjacent lots are located in one box together with the transformers, meters, cut-offs, and lightening arresters. D.C. power will be supplied to the Terminal and Street Railway.

The streets will be lighted by posts having single high power tungsten lamps. Wires for such lamps will be carried within the curb and will connect at the alleys to the power distribution system. However, the lighting cables are entirely independent of the power cables and the regulation of the lights is controlled from the plants.

The electric light and power system is shown on platell.

#### Telephone:-

The telephone lines are carried beneath the alley and connection to four adjacent lots made through one box. The telephone system is shown on plate 12.

#### Provision for Community Expansion.

The residence district can expand in only one



direction: that is Northward. In the town layout Compton Avenue, Armstrong Boulevard, and Penn Avenue are extended North of Sproesser Street, and the public utility connections are provided here for any future use.





# SPROESSER STREET

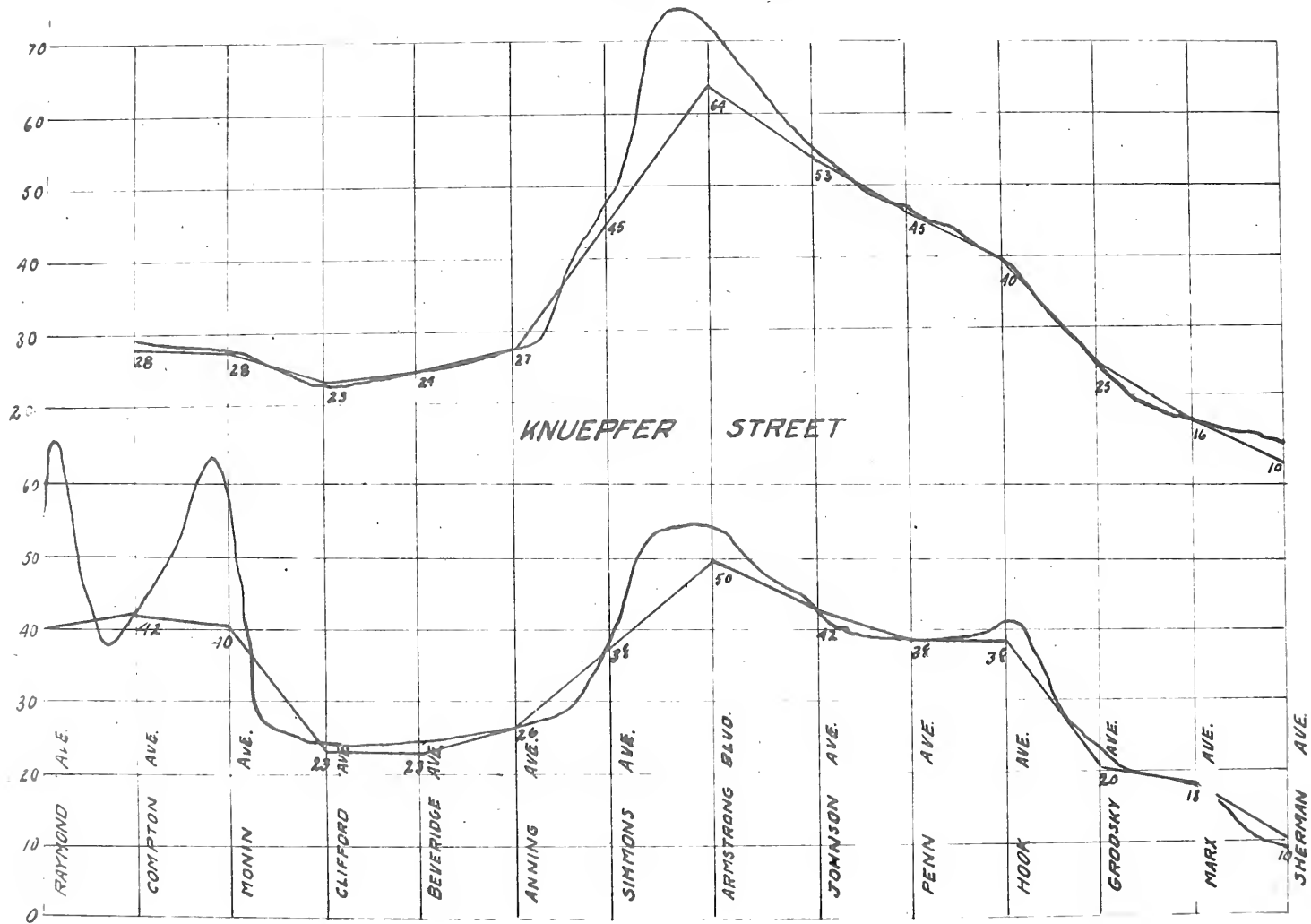
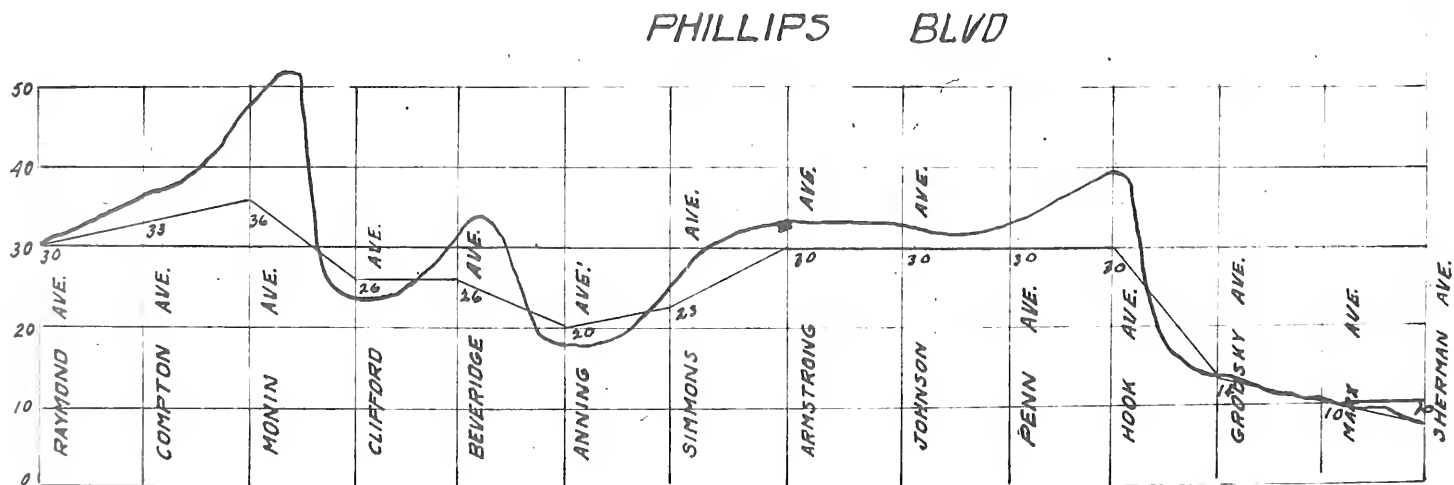
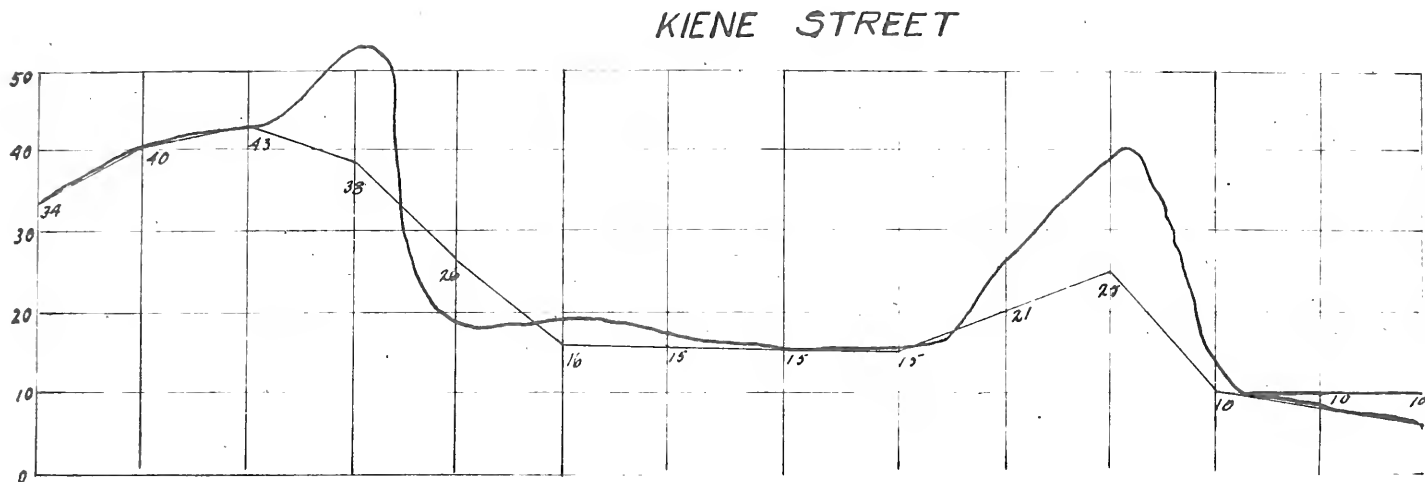
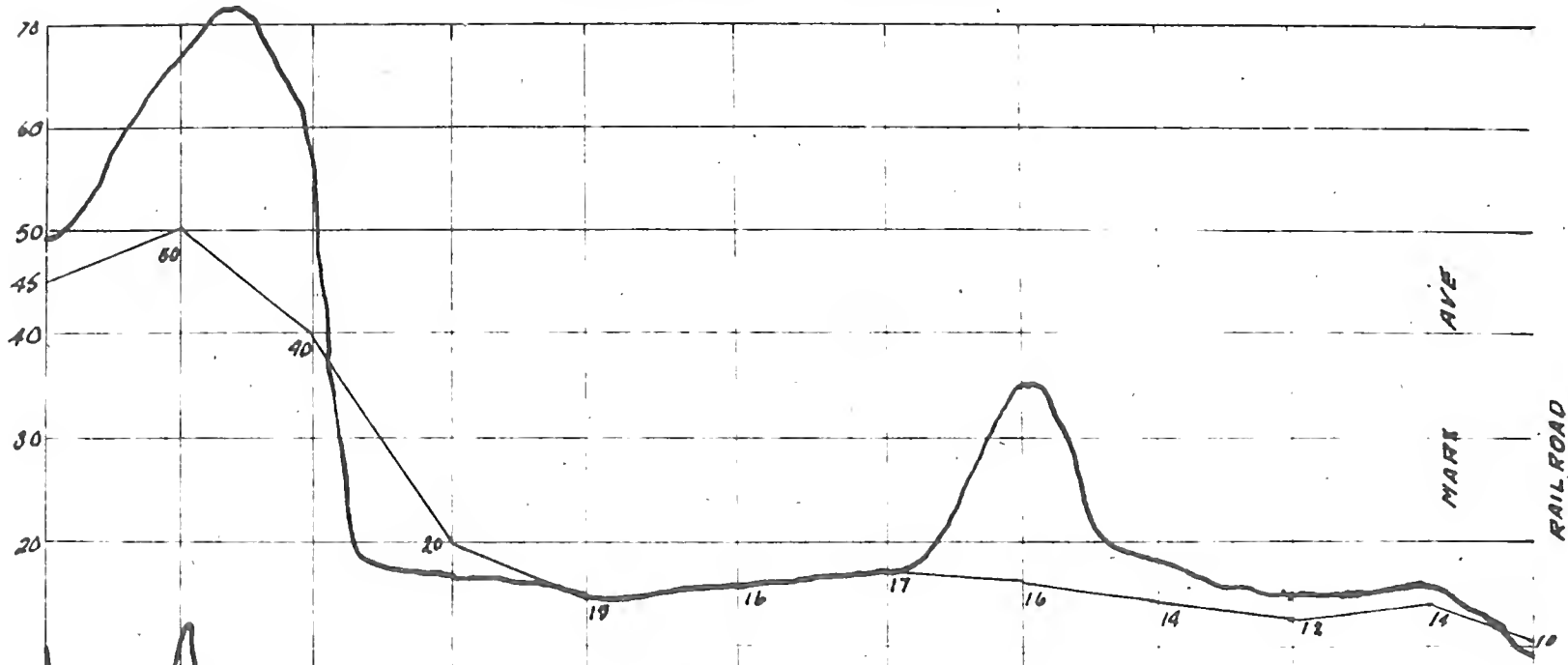


Fig. 1



# TRINKAUS STREET



# DEITENBECK STREET

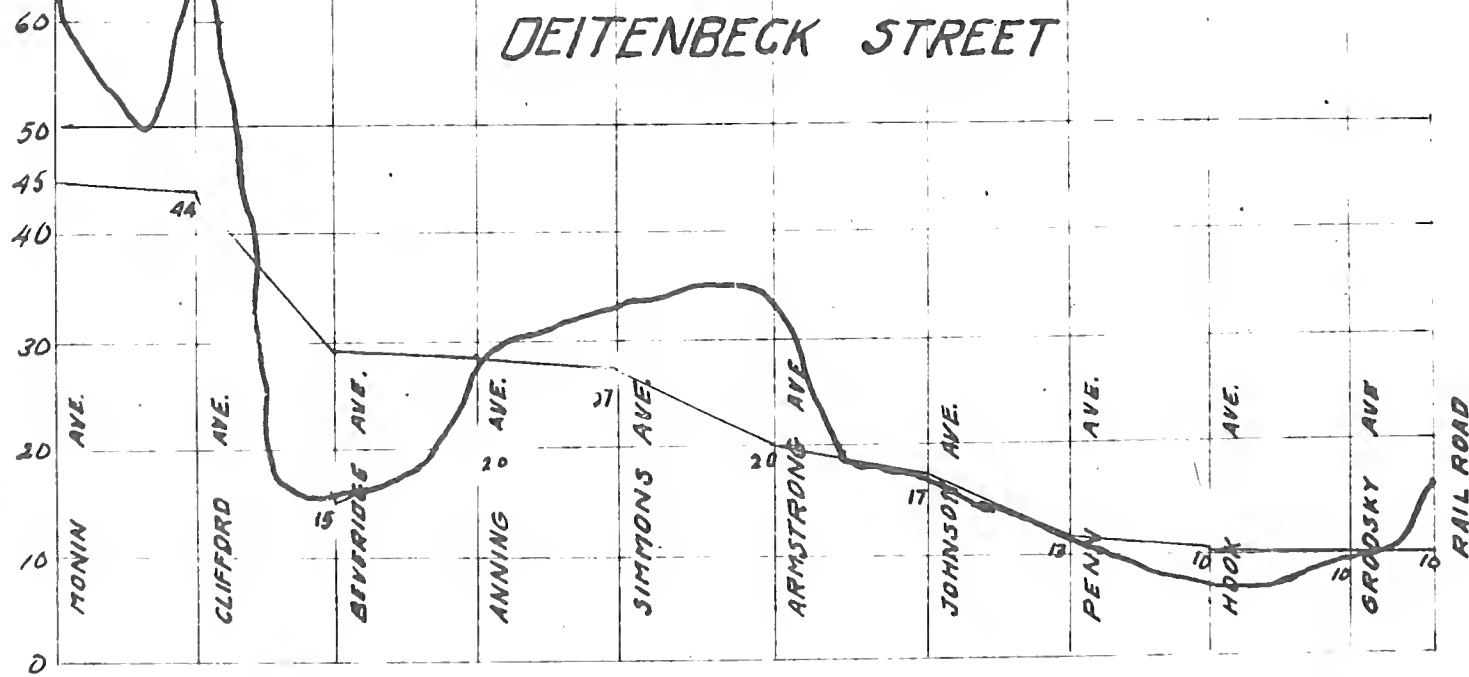
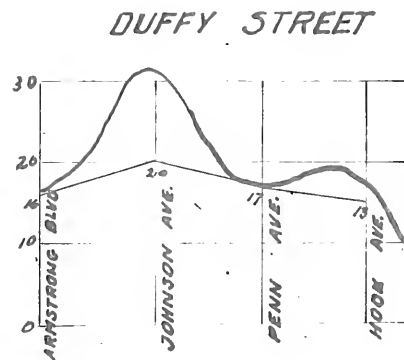
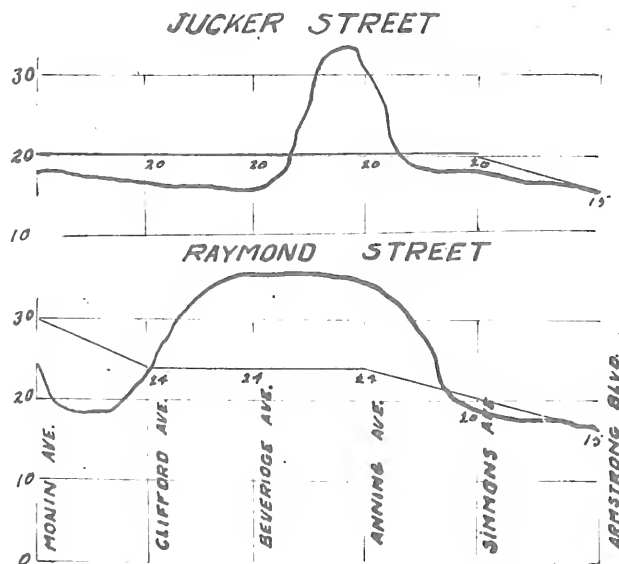
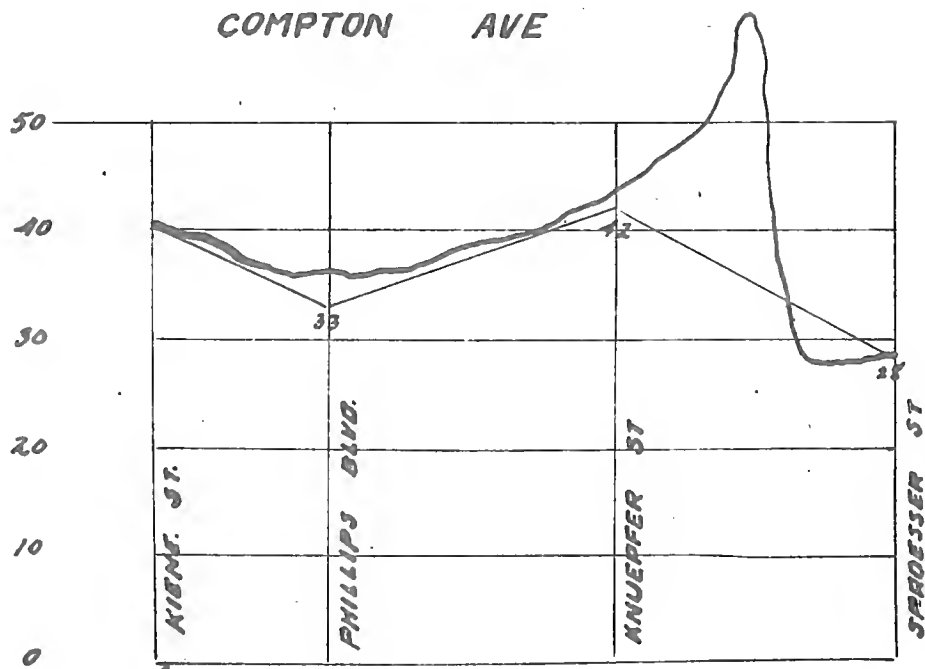
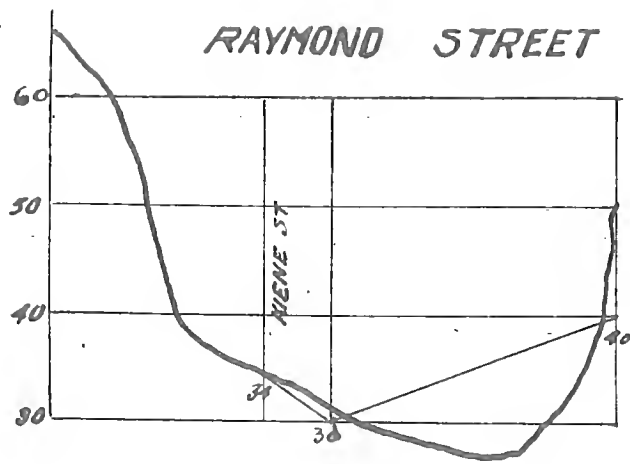


Fig. 3





# MONIN AVE.

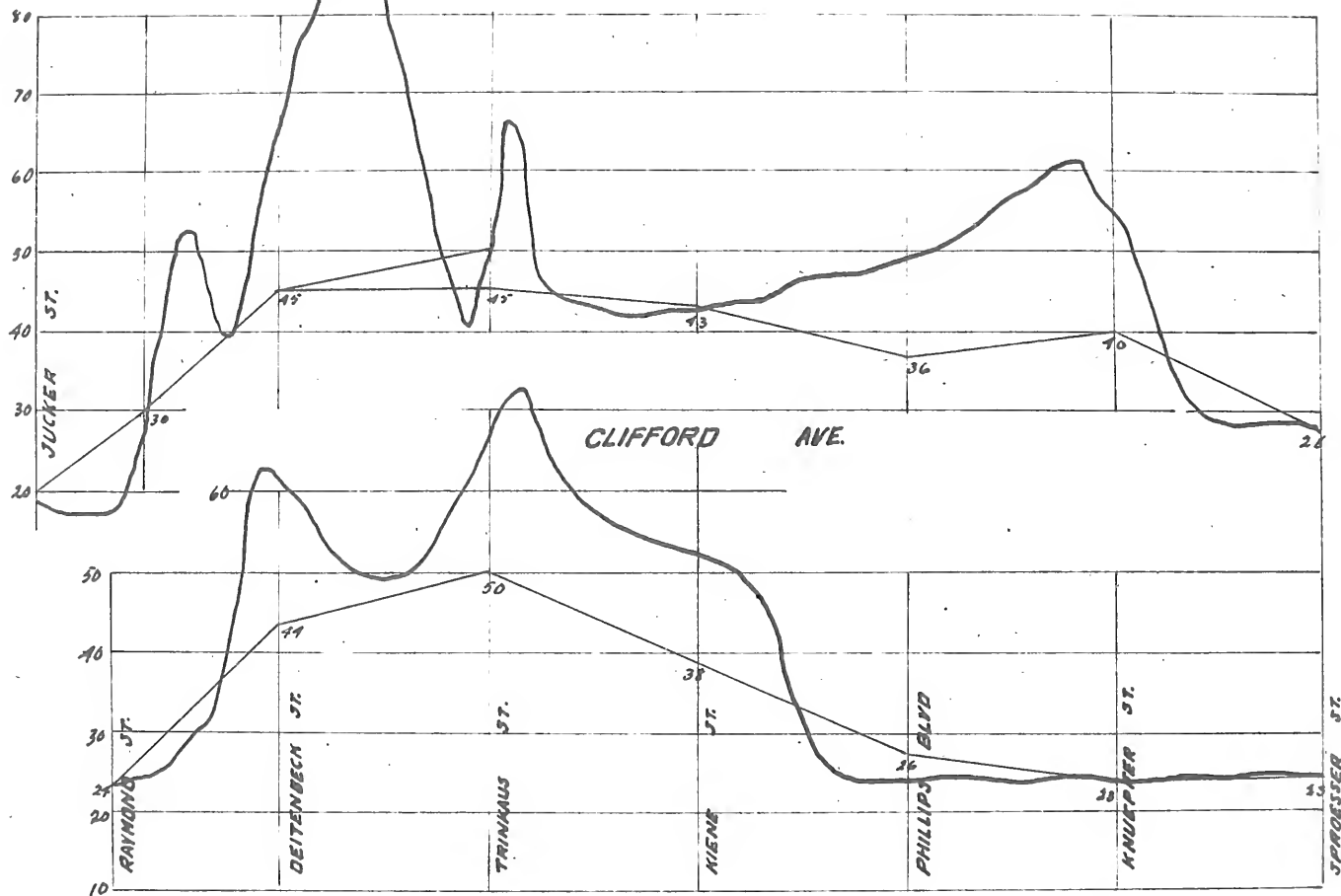


Fig. 6

# BEVERIDGE AVE.

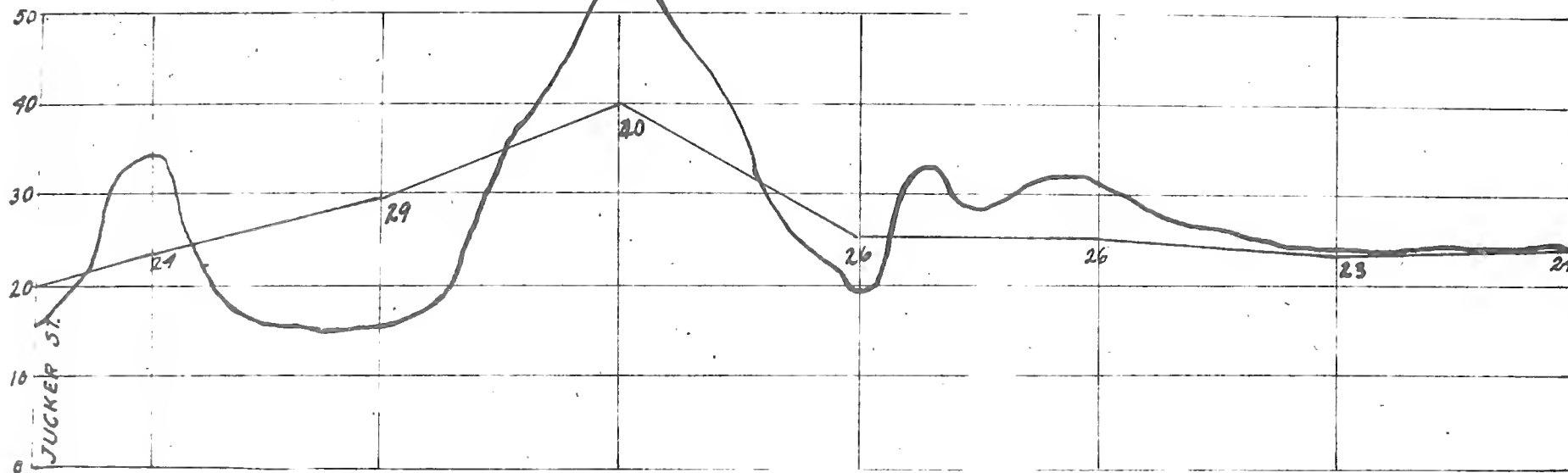
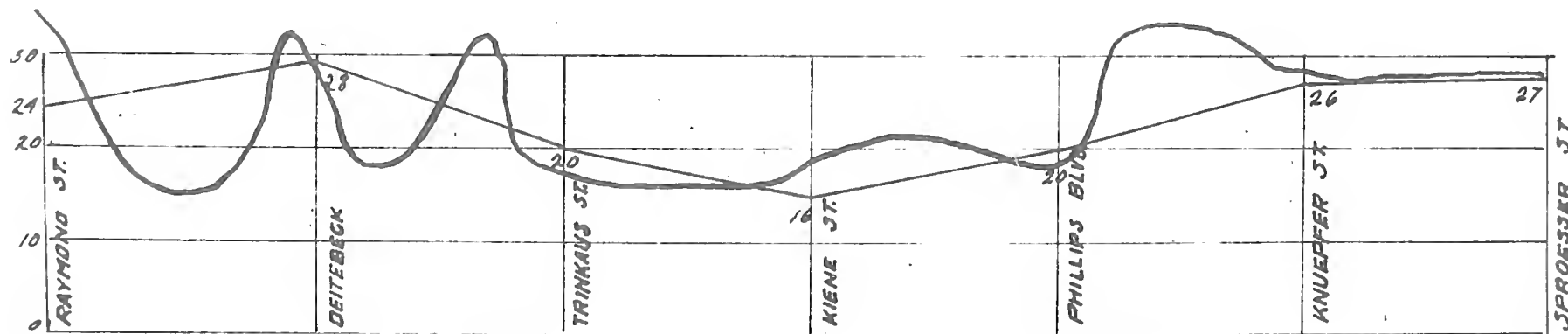


Fig. 7

# ANNING AVE



# SIMMONS AVE.

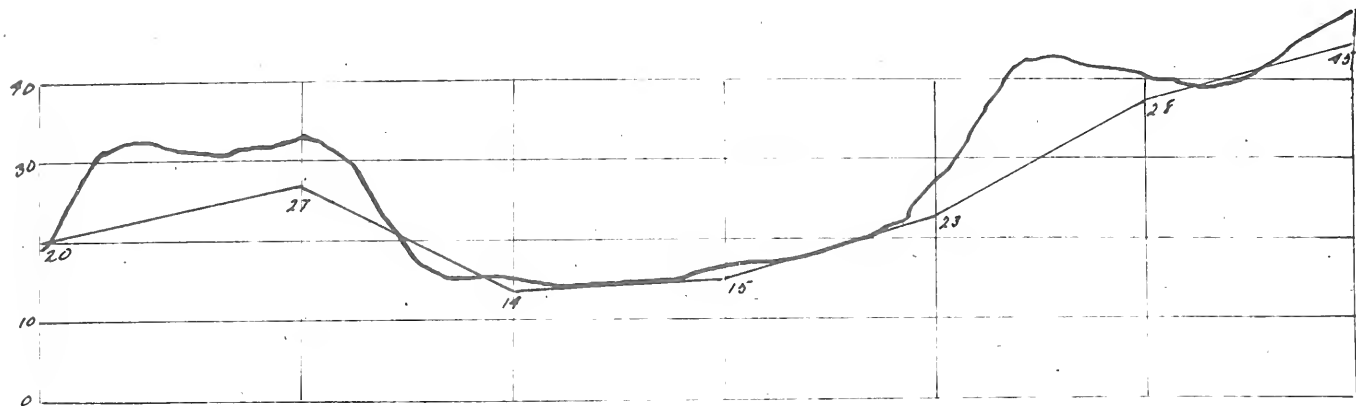
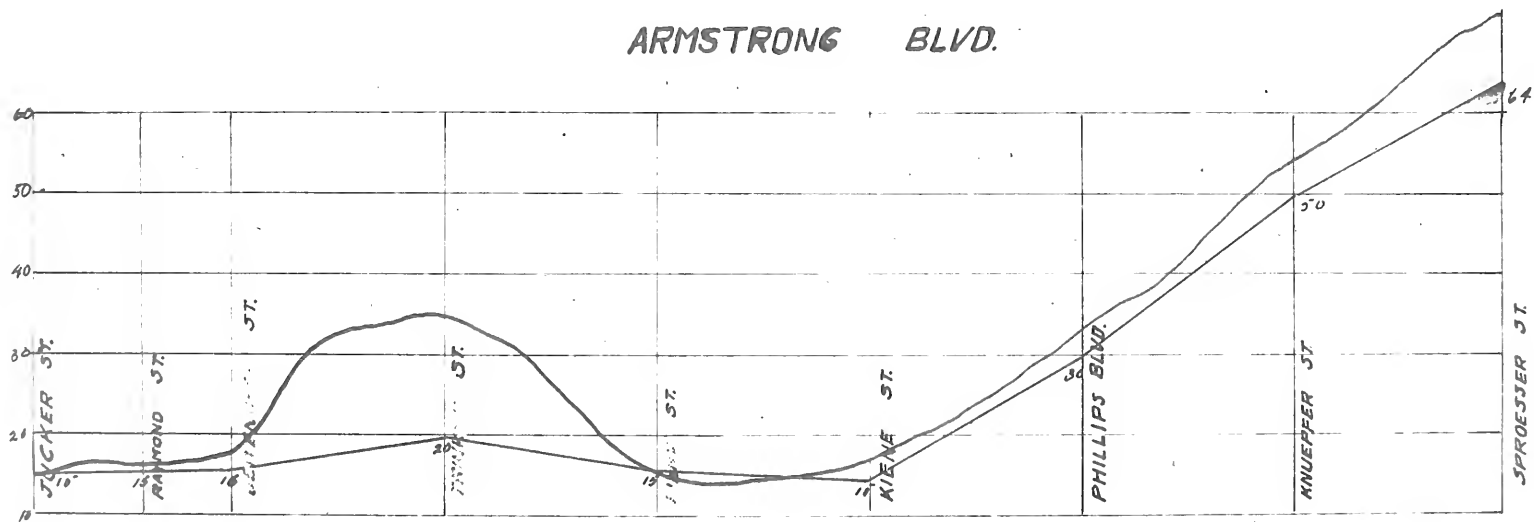


Fig. 8

# ARMSTRONG BLVD.



# JOHNSON AVE.

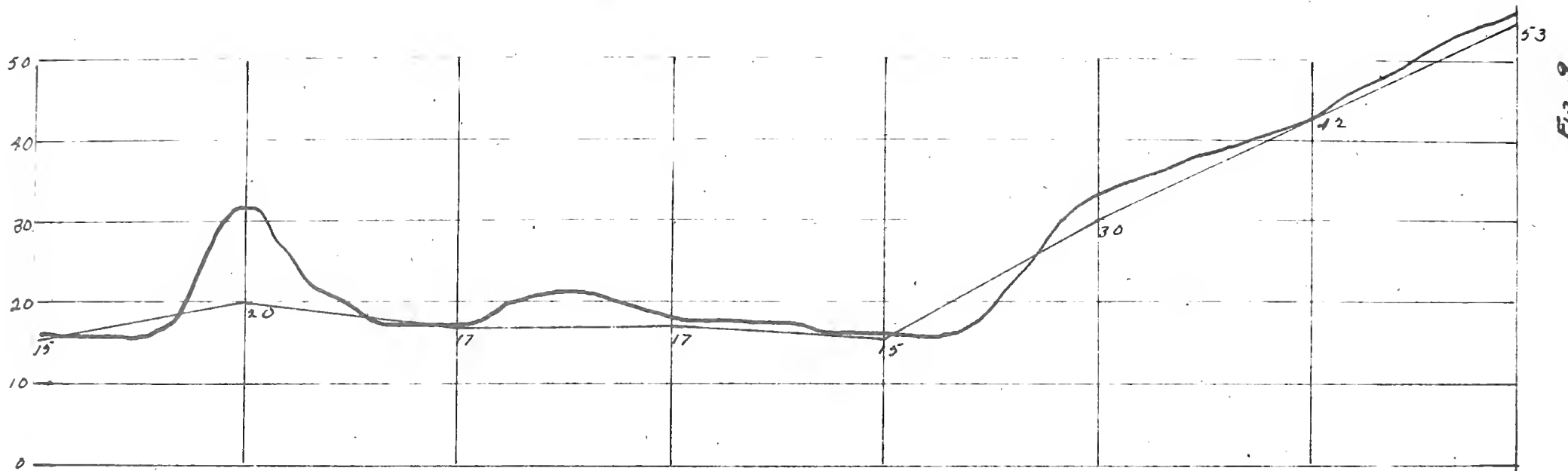
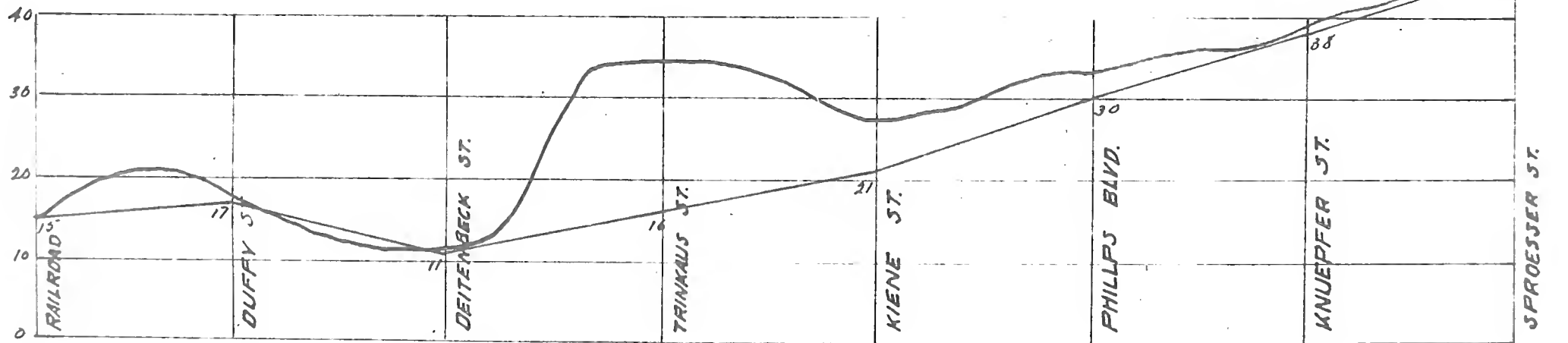


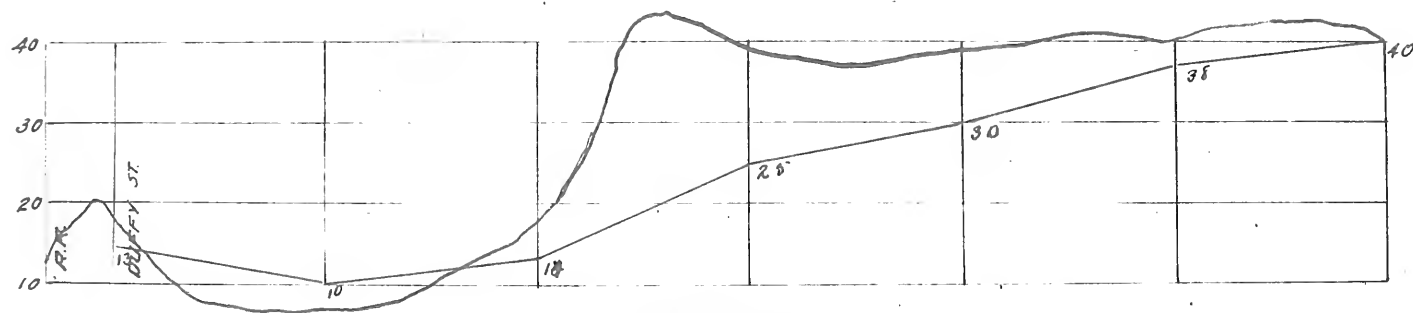
Fig. 9

# PENN AVE.

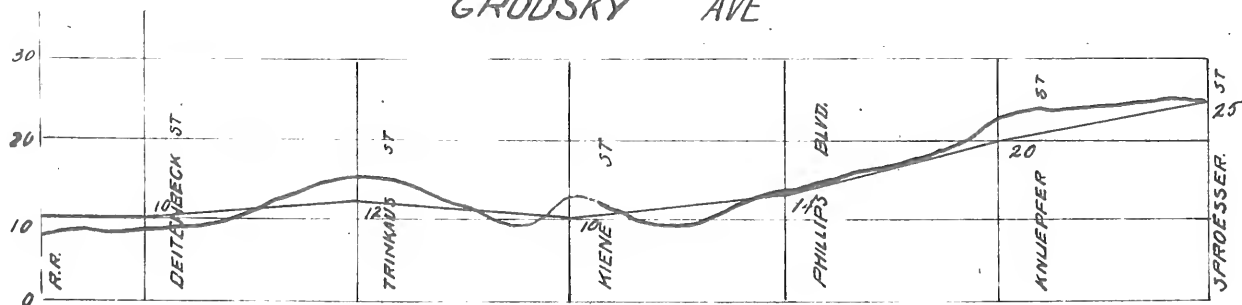


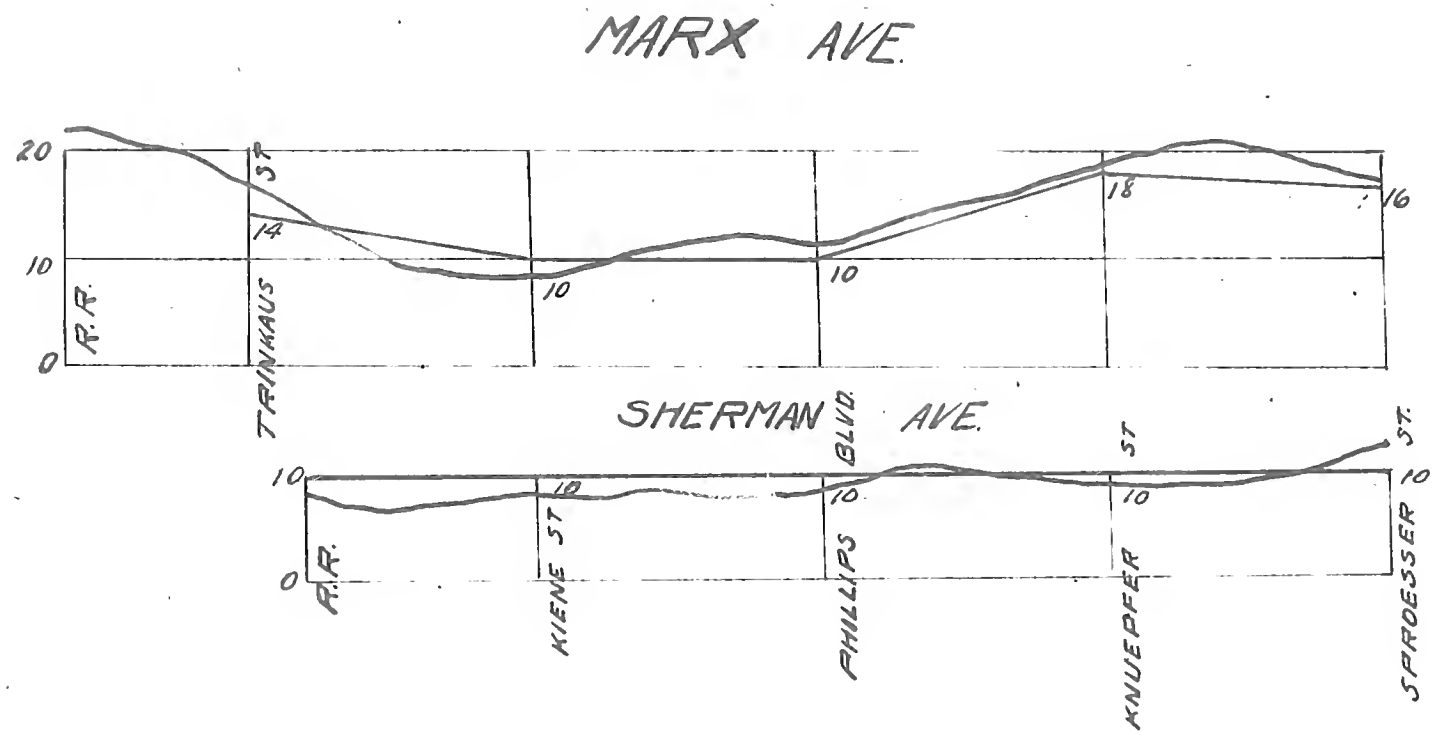
SPROESSER ST.

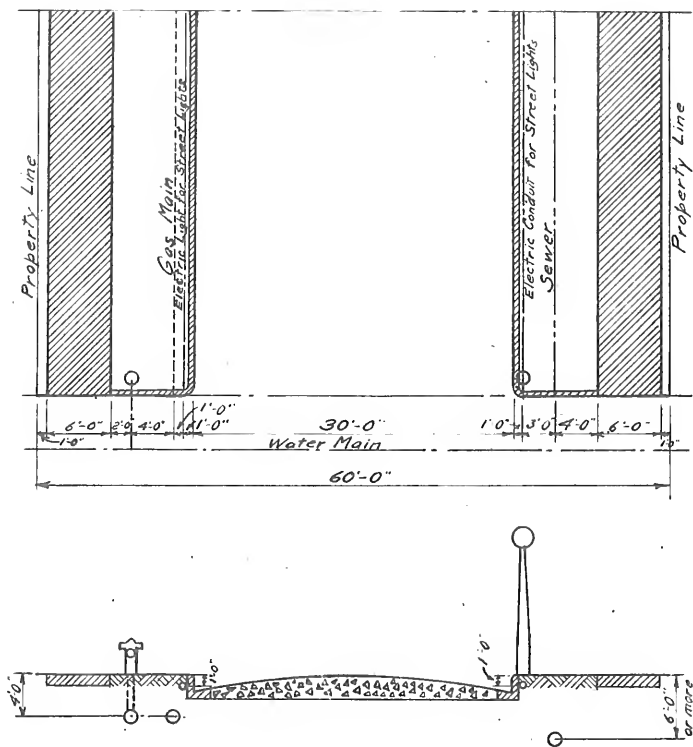
## HOOK AVE



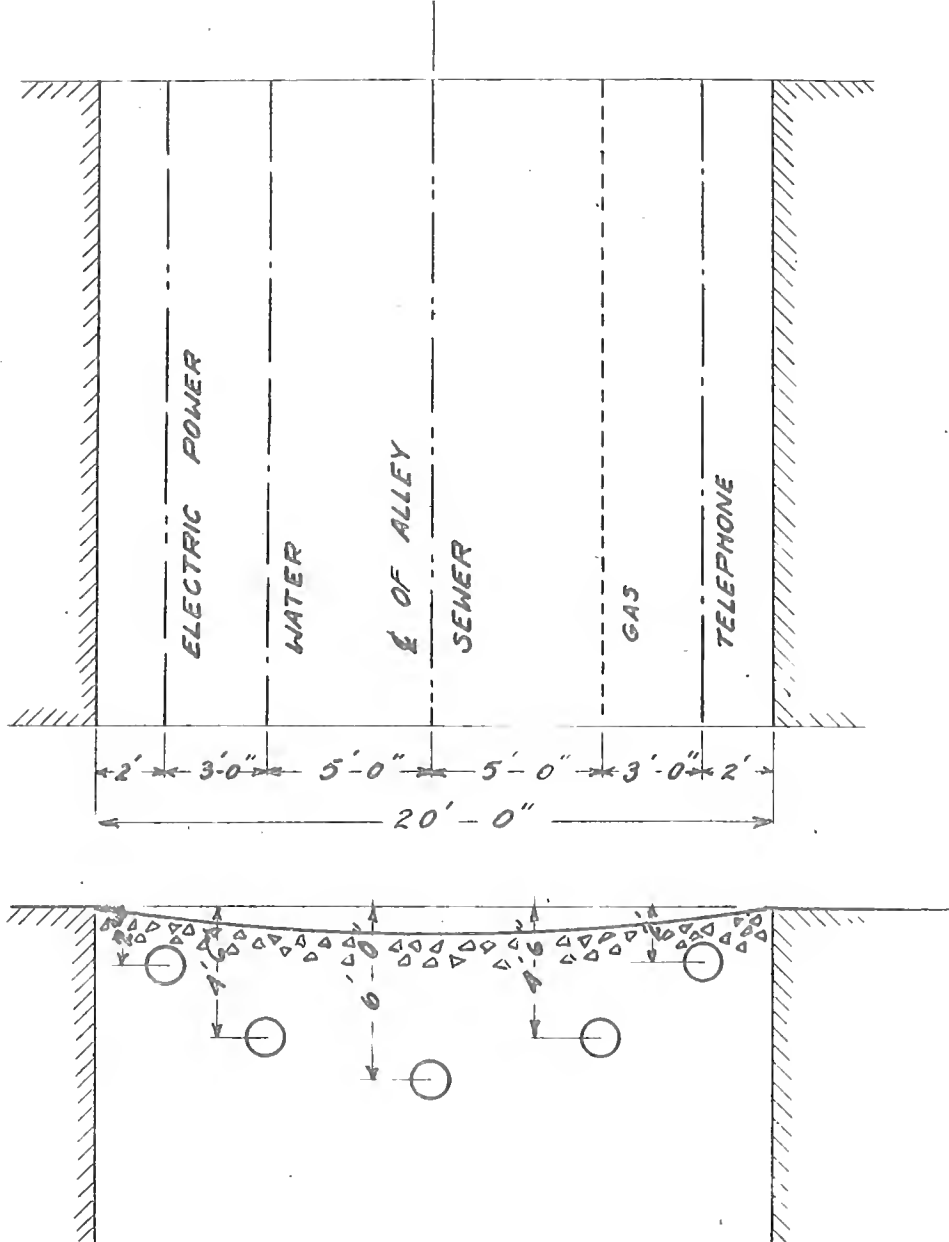
## GRODSKY AVE



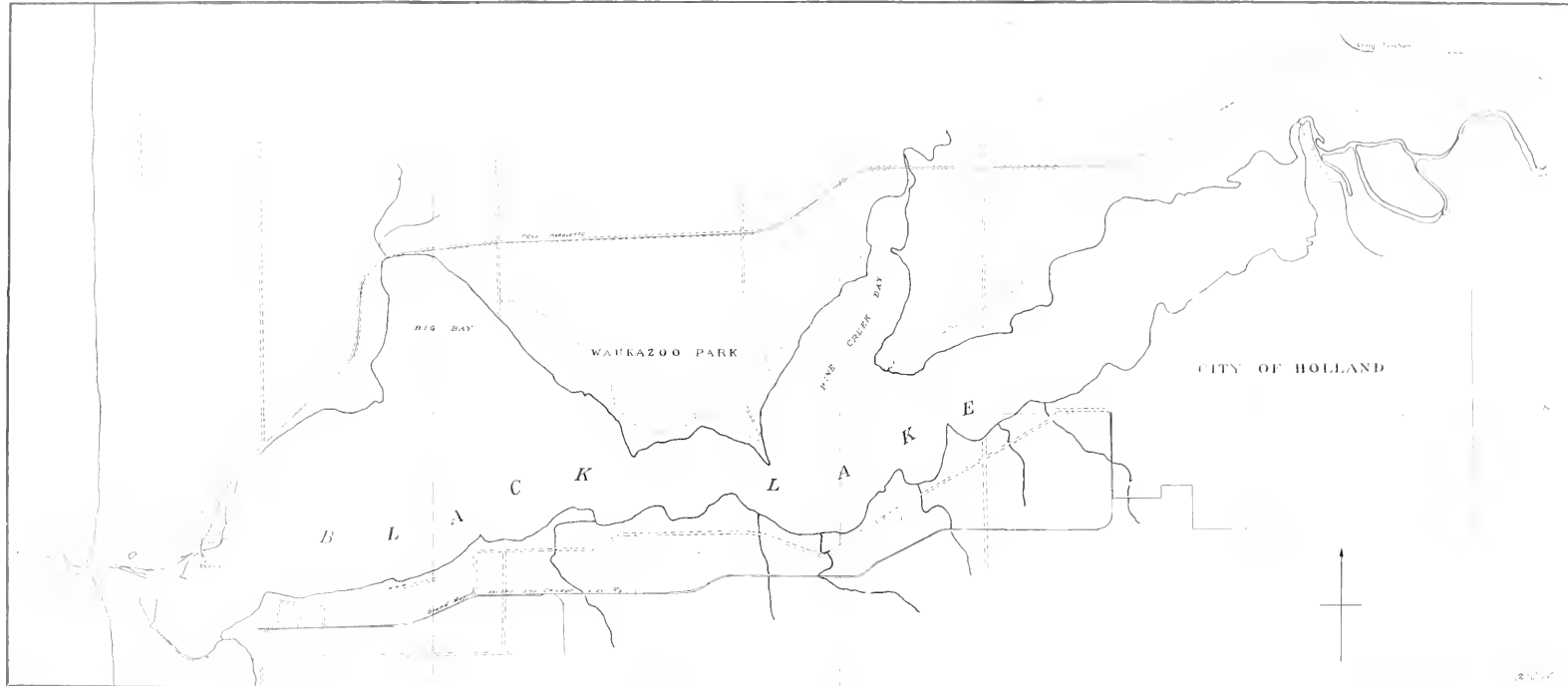


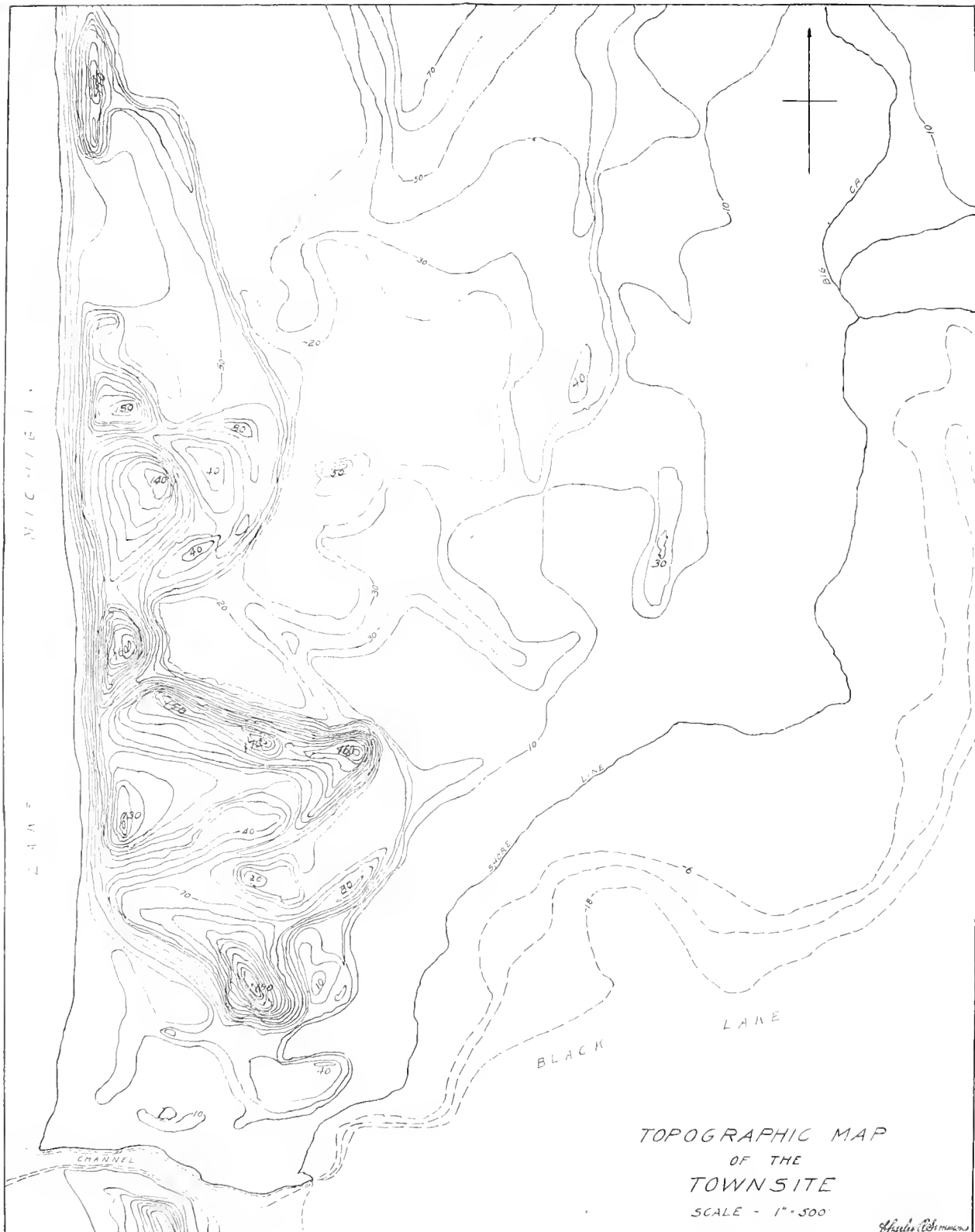


TYPICAL STREET SECTION



TYPICAL ALLEY SECTION



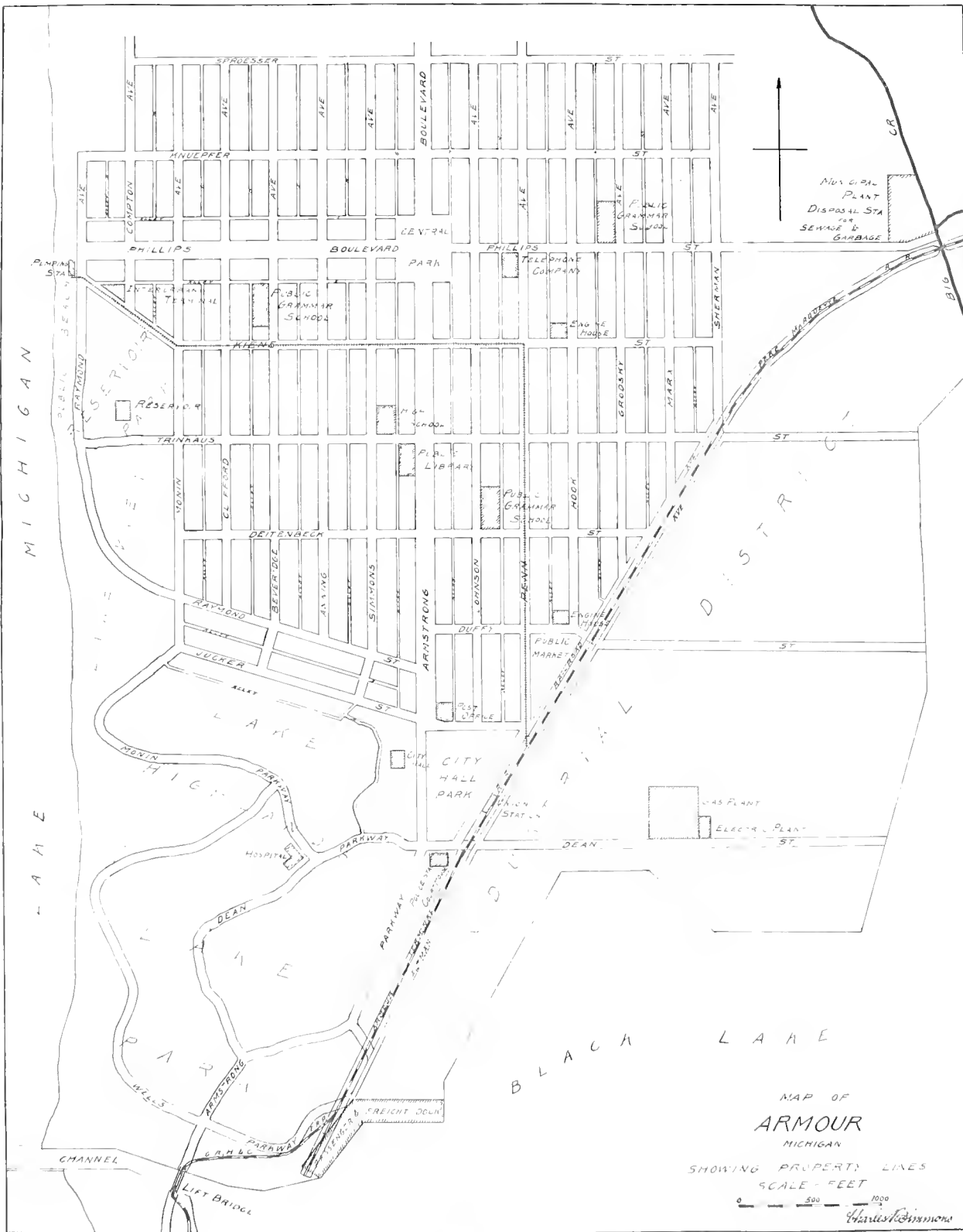


TOPOGRAPHIC MAP  
OF THE  
TOWNSITE

SCALE - 1" = 500'

H. B. HARRISON  
PLATE 2





MICHIGAN

LAKE



MUNICIPAL  
PLANT  
DISPOSAL STA  
FOR  
SEWAGE &  
GARBAGE

DISTRICT

WAS PLANT  
ELECTR. PLANT

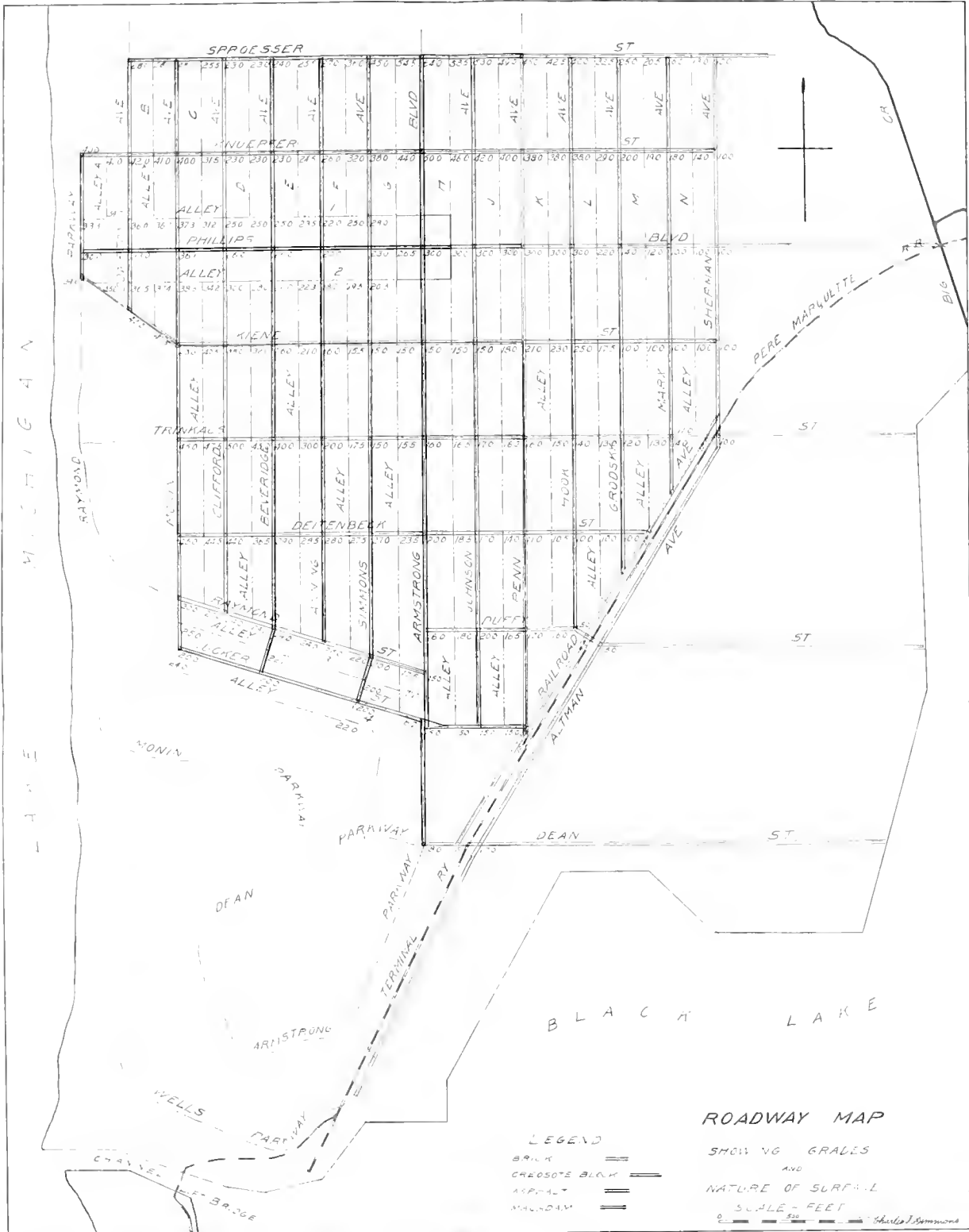
MAP OF  
ARMOUR  
MICHIGAN

SHOWING PROPERTY LINES  
SCALE - FEET

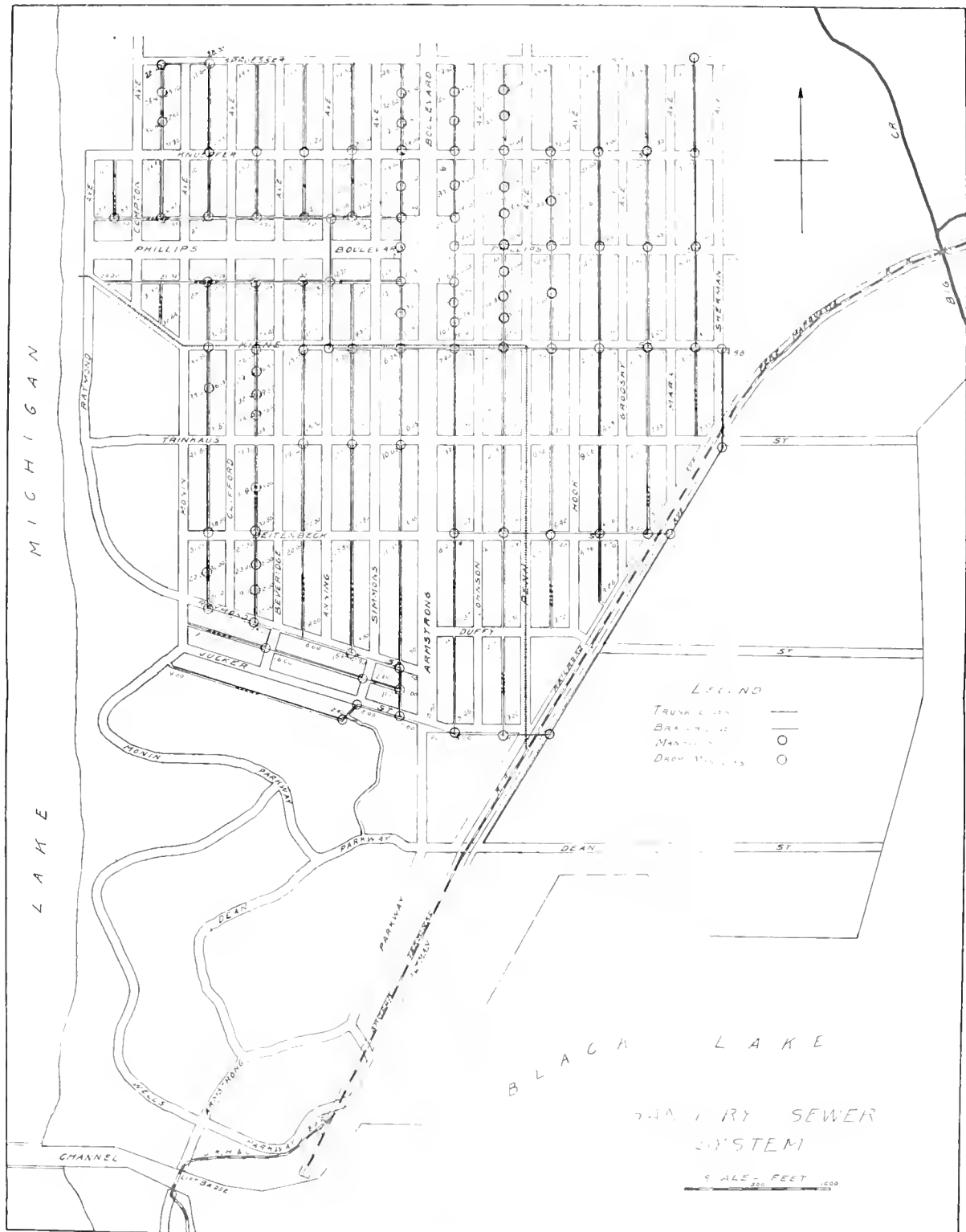
0 500 1000

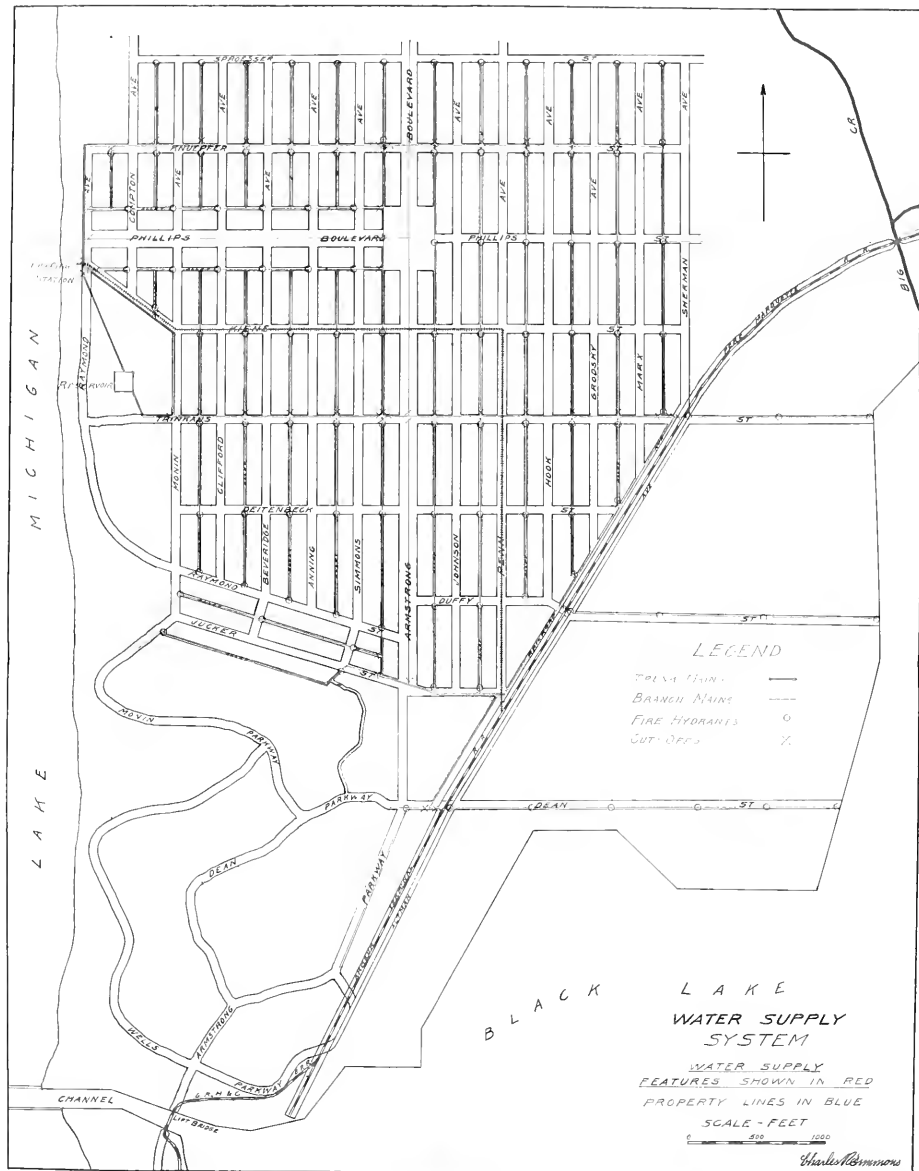
Harold Simmons

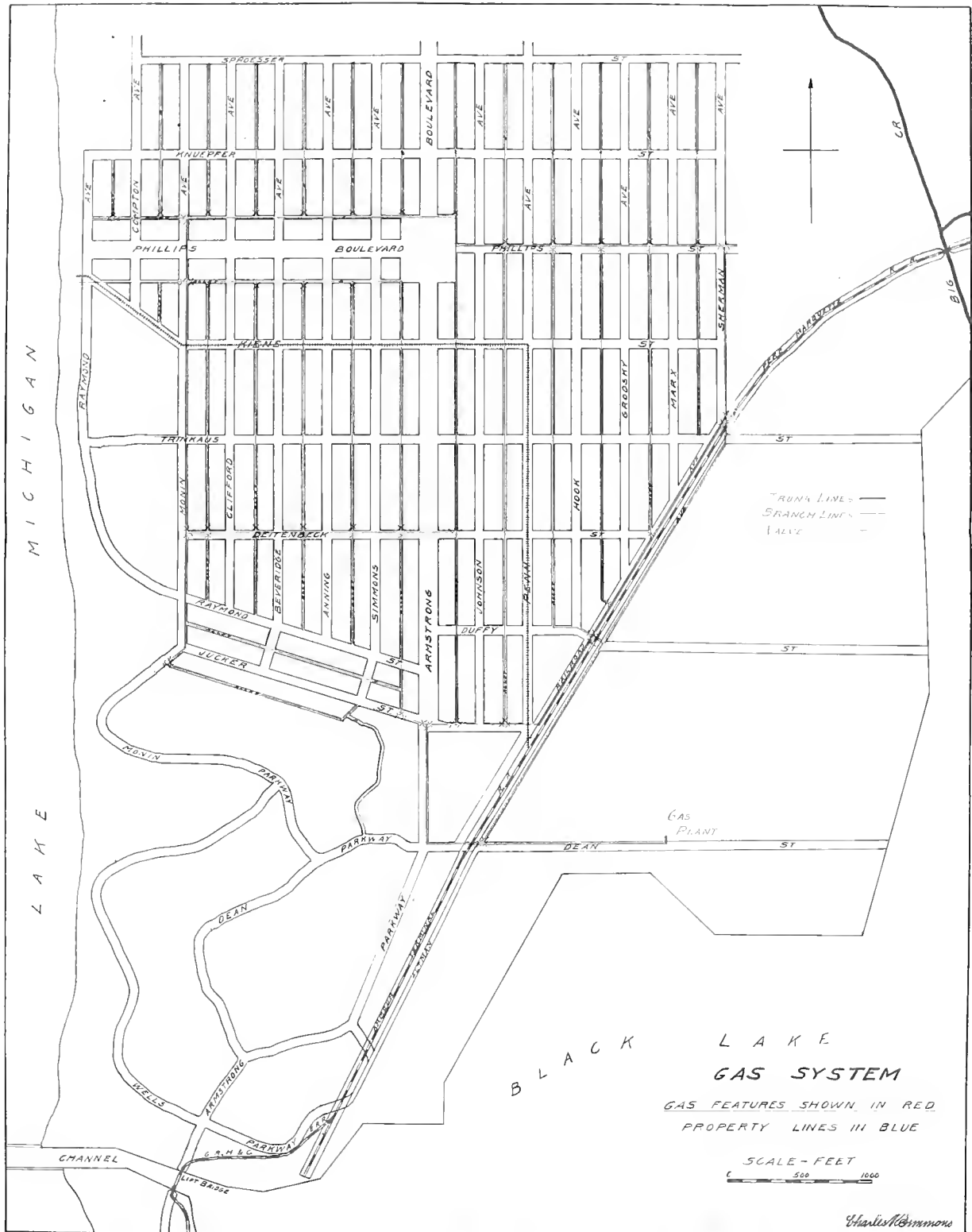


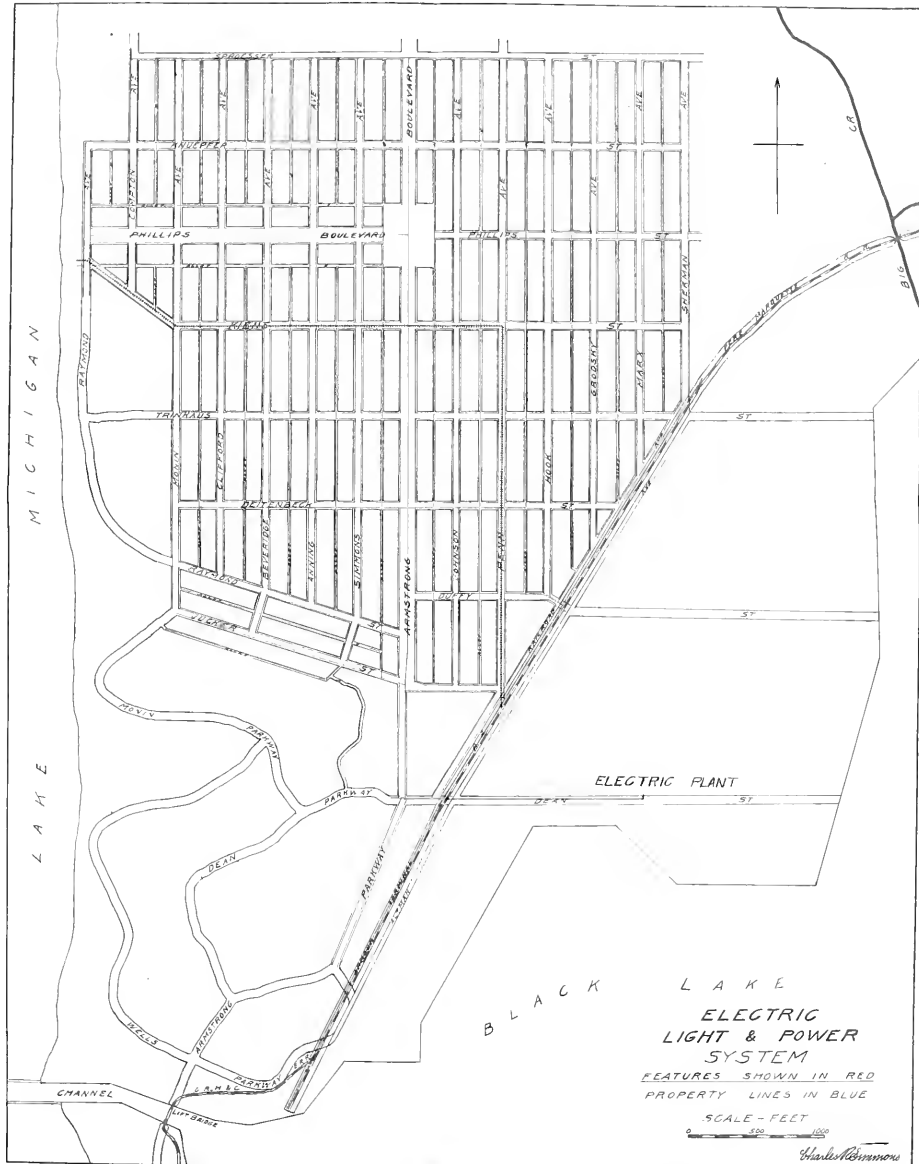


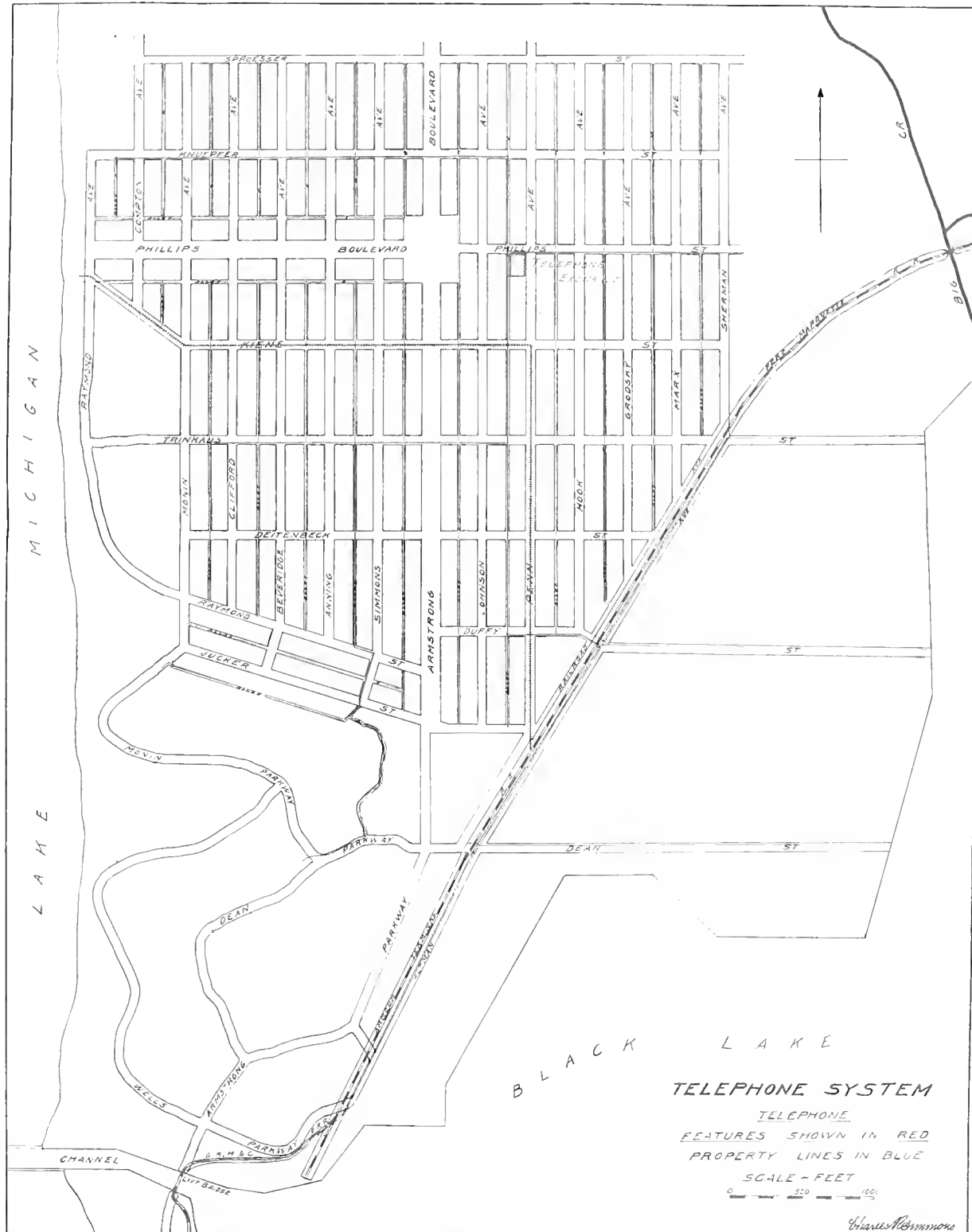












L A K E M I C H I G A N

B L A C K L A K E  
TELEPHONE SYSTEM

TELEPHONE  
FEATURES SHOWN IN RED  
PROPERTY LINES IN BLUE

SCALE - FEET  
0 50 100

Charles H. Simmons

MAP OF  
ARMOUR  
MICHIGAN

SCALE - FEET

700  
3  
700

MONIN

PARKWAY

UCHER

STREET

STREET

ARMSTRONG

RAYMOND

BEVERIDGE

SIMMONS

MONIN

CLIFFORD

DEITENBECK

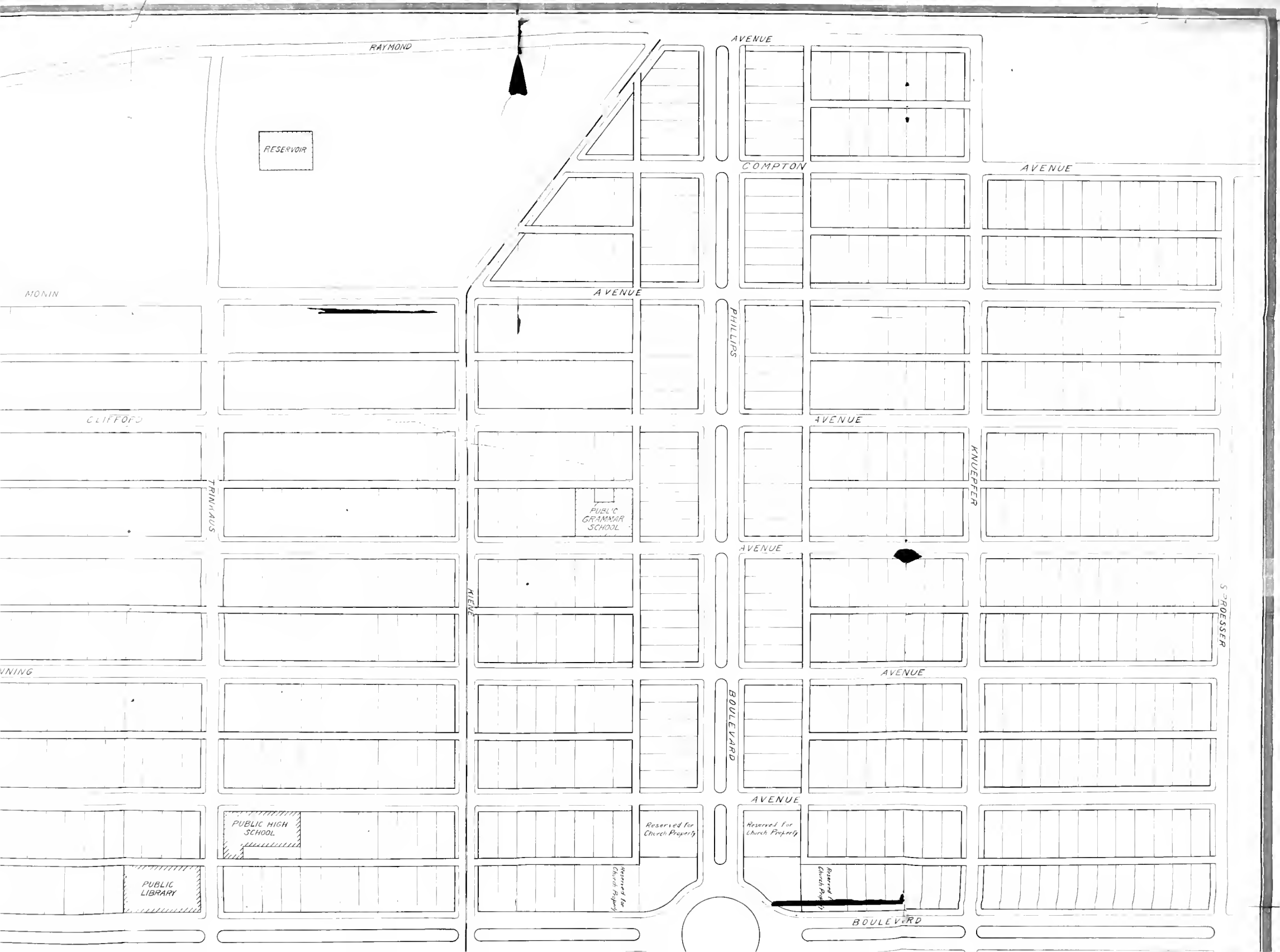
ANNING

TRINIAUS

RESERVOIR

PUBLIC HIGH  
SCHOOL

PUBLIC  
LIBRARY



RAYMOND

AVENUE

RESERVOIR

COMPTON

AVENUE

MONIN

AVENUE

PHILLIPS

CLIFFORD

AVENUE

TRINIAUS

PUBLIC  
GRAMMAR  
SCHOOL

KNUEFFER

AVENUE

S-ROESSER

VNING

MEINE

AVENUE

BOULEVARD

PUBLIC HIGH  
SCHOOL

Reserved for  
Church Property

AVENUE

Reserved for  
Church Property

PUBLIC  
LIBRARY

Reserved for  
Church Property

Reserved for  
Church Property

BOULEVARD



CITY HALL PARK

ARMSTRONG

JOHNSON

PENN

HOOK

GRODSKY

AVENUE

PUBLIC MARKET

POST OFFICE

PUBLIC LIBRARY

PUBLIC GRAMMAR SCHOOL

PUBLIC HIGH SCHOOL

ENGINE HOUSE

STANBURY TERMINAL

RAILROAD

RAILROAD

STREET

STREET

STREET

STREET

DUFFY

STREET

DEAN

STREET

GAS PLANT

ELECTRIC POWER PLANT

TOWN HALL

PUBLIC GRAMMAR SCHOOL





